The
Electrical Review

VOL. CXXIV. MAY 26, 1939 No. 3209.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Waterloo 3333 (50 lines).

The "Electrical Review" is the recognised medium of the electrical trades and has by far the largest circulation of any electrical industrial paper in Great Britain.

SUBSCRIPTION RATES, Postage free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

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Generation Efficiency

New Brimsdown "A" Plant

A FEW years ago there was an outcry to the effect that the additional capital expenditure necessary to increase power station thermal efficiencies from, say, the 21 per cent. mark, would not be justified. Since then overall efficiencies have been increased to more than 27 per cent. and working results appear to show that all is well. For all that, there must be a limit to the capital expenditure figure, but the time to fix it appears always to lag behind technical developments and therein lies the courage (some critics call it the gambling spirit) of the responsible engineers.

The courage of Captain Donaldson, general manager of the North Metropolitan Electric Power Supply Co., has long been a driving force in the electrical industry, but in the reconditioning of Brimsdown "A" he seems to have excelled himself. Will the results prove him right once again? We do not feel at all perturbed about this, as the anticipated overall thermal efficiency of not less than 30 per cent. (actually 29.25 per cent. has already been obtained on a week's run) is certainly not the result of an inflated capital expenditure.

Capital Cost

Excluding the cost of land, which is cheap in that neighbourhood and allowing for the use of existing buildings—the cost of adapting which, we are informed, has considerably discounted their value as an asset—the capital cost of the new plant works out at something like £12 10s. per kW. It is true that some advantage accrues from the use of the older boilers, both as potential stand-by for the low-pressure set and also to provide steam for starting up. On the other hand, there is a sacrifice of operating efficiency due to the low reheat pressure (200 lb. per sq. in.) which is entailed in fitting in the new steam system with existing arrangements.

The improvement in the heat cycle contributing to this high efficiency has been brought about by steam reheating in conjunction with the use of the highest initial steam pressure and almost the highest steam temperature yet adopted for public supply in this country. The energy required for works power is lower than might be expected for high-pressure work, owing largely to the high efficiency of the reciprocating pumps installed. Criticisms sometimes heard of the complications introduced by reheating were not borne out by impressions received during a recent visit to the station.

While to-day the ultimate possibilities of the steam cycle seem less certain than they did even ten years ago, there is a feeling in some quarters that high efficiency may be attained at the expense of reliability, on the ground that 50,000 kW and more is too much for one generating block.

At Brimsdown "A" the generating plant is in two distinct sets and the low-pressure unit can be operated independently, either from the high-pressure boilers through reducing valves or from the low-pressure boilers. This disposes of any suggestion that all the eggs are in one basket. Moreover, Brimsdown "A" and "B" are electrically connected.

Control Methods

Flexibility of operation is another critical point and closely allied to supply continuity. The Ward-Leonard control of the auxiliaries at Brimsdown "A," as at the privately owned pulverised-fuel station at the Ebbw Vale steelworks which we saw recently, seems to be a definite assurance in this connection, although it has yet to be proved whether the master control of two 210,000-lb. per hr. boilers as one unit under certain load conditions is not too ambitious.

It is an interesting speculation to compare the Brimsdown "A" scheme with the superimposition idea by which a high-pressure turbine is added to an existing station to increase the efficiency of the station as a whole. In an article in the I.E.E. *Journal*, Sir Leonard Pearce says that the thermal efficiency of existing stations might be increased by 15 to 35 per cent. by "topping."

If we regard high-pressure generation at Brimsdown "A" purely as a superimposition scheme which has raised the efficiency of the station by 25 per cent., to take the mean of these figures, then without the high-pressure generation the station efficiency would be about 24 per cent., and that is probably what the efficiency of a new low-pressure station would be nowadays. The equivalent saving in fuel would be worth the addition of more than 25 per cent. to the cost of the plant, so that capital expenditure that would have been warranted a few years ago (had the state of metallurgy permitted) is all the more so to-day in view of the higher price of coal.

Power Stations and Amenities

IN our issue of March 10th, we commented on the proposal of the North-West Midlands J.E.A. to erect a 120,000-kW station, which is required to meet the load anticipated in the autumn of 1943. As a result of local opposition, mainly on the ground of a feared destruction of amenities, the Electricity Commissioners are to hold a public inquiry on June 6th. Possibly few of the objectors have had an opportunity of seeing how a power station can be designed to be in unobtrusive accord with its natural surroundings and indeed, in many cases, to form a pleasing architectural acquisition to the neighbourhood. Examples that occur to us are Ironbridge (West Midlands J.E.A.), Portishead (Bristol) and several hydro-electric schemes in Scotland—not to mention many stations on the Continent. Dust from coal and spray from cooling towers are other objections advanced, but these have been successfully met elsewhere. Moreover, the performance of the very much larger stations at Battersea and Fulham shows that large-scale generation on modern lines can be carried out even in the most densely populated areas without the results feared by the residents of Barlaston.

Gas at the B.I.F.

IT is somewhat of a surprise that the gas industry has decided not to repeat its excellent display at the British Industries Fair next year. There will only be an industrial gas section organised, according to the *Gas Times*, by the industrial centres. The decision should give added force to next year's electrical display which, it is hoped, will be even better than usual. Whatever our rivals' reasons for withdrawal may have been we cannot think that it was wise of them to leave the domestic field to our industry—but why should we lament this? We must say, however, that the gas section was an example and a stimulus which some electrical concerns badly needed, and its absence must not be considered a good reason for a relaxation of effort. What we need is a bigger, brighter and better co-ordinated display, and now is the time to get to work on it.

Swiss Industry

DURING a recent visit to Switzerland we were able to visit two of the leading engineering works in the Zürich district, and we found both of them very well occupied. No doubt the pressure of armament work in our own shops has benefited the Swiss to some extent, but originality and sound design have something to do with it too. Switzerland depends to a greater extent than we do upon export markets and has to import practically all her raw materials, but in spite of this, and without subsidies, she does very well. The Swiss National Exhibition, which was the primary object of our visit, depicts the country's social life and industrial activities in a most striking fashion. The brief notes in this issue cannot do it full justice, and we heartily recommend those who are going to Switzerland between now and October to visit the show.

The Entrance Thesis

IN addition to the new members enrolled in the I.E.E. last year from among the 606 candidates who sat for the orthodox graduateship examination, there were forty who were admitted to the ranks of associate members by way of theses. It is gratifying to hear that the I.E.E. Council found itself able to award the Page Prize for the best of the papers submitted (it is only bestowed when one is of sufficient merit) as the ability to prepare a really good thesis, based upon first-hand experience is, no doubt, a better way of testing a man's qualifications than his aptitude for answering examination questions, particularly if he is of post-graduate age. The subject chosen by the successful candidate (Mr. R. Newing)—"Equipment and Distribution for Large Industrial Undertakings"—is one about which more might well be published in institution proceedings generally. The setting up of an Installation Section is under consideration by the Council of the I.E.E. and it is to be hoped that the proposal will mature in time for inclusion in next session's programme.

G.W.R. Electrification

WHILE the decision of the G.W.R. not to proceed with the £4,000,000 electrification of the Taunton-Penzance line is disappointing, it must be recognised that there were many factors peculiarly adverse to a change over. To begin with, the traffic density on the many branch lines was, in most cases, too low to justify the capital expenditure, while a number of difficult features were presented in the main line proposals, e.g., heavy gradients, great number of curves, and the need to raise a large number of bridges, militated against the making out of a case on economic grounds. The chief obstacle appears to have been the seasonal nature of the traffic—a factor we cannot recall as having exerted a predominating influence before. While the miles run per locomotive per single track mile was about the same as that which justified the Manchester-Sheffield electrification, the consulting engineers (Messrs. Merz and McLellan) report that most of the traffic on the Taunton-Penzance line, which is two-thirds passenger, is confined to the summer, more particularly to the week-ends. This low traffic load factor would mean greater expenditure on equipment which would not be used for more than a comparatively few hours in the year. The electric locomotives (164 were allowed for) would replace only the same number of steam engines, whereas in the L.N.E.R. scheme, we believe, they are expected to replace twice their number, which is a very potent argument in favour of conversion.

"Black" Lamps and A.R.P.

WHILE the darkening of industrial works during an air raid would no doubt reduce the risk of damage, such action might result in injuries to employees who found themselves suddenly in the dark. In this connection full advantage should be taken of recently introduced methods of using ultra-violet rays from "black" mercury-vapour lamps (which give practically no visible light) to excite fluorescent powders. Signs made by the application of a suitable paint or by the use of plastic mouldings in which fluorescent powders are incorporated should be erected in suitable positions to indicate obstacles and exits to safety quarters, for instance. If the supply of electricity should fail for any reason the phosphorescent powder composition should glow for a couple of hours or more. No doubt the principle will be adopted readily enough in power stations and substations for illuminating such key items as controls, instruments and labels, but it should not stop there. Supply engineers might well go out of their way, in the interests of safety in emergency, to see that those not so closely in touch with electrical developments in general are fully informed of the possibilities of this one in particular.

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A RECONDITIONED STATION

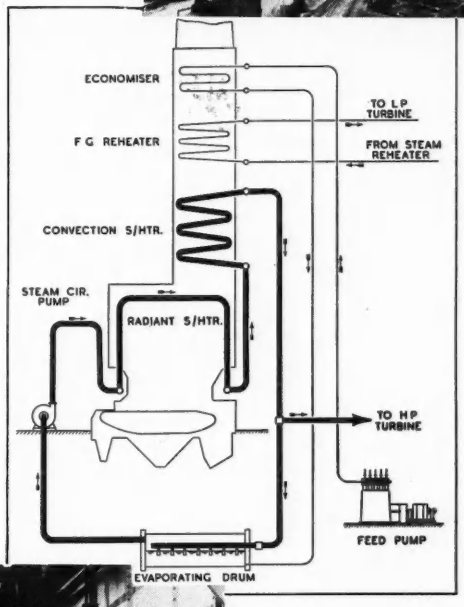
Extra-high-pressure Boiler and Turbine Plant

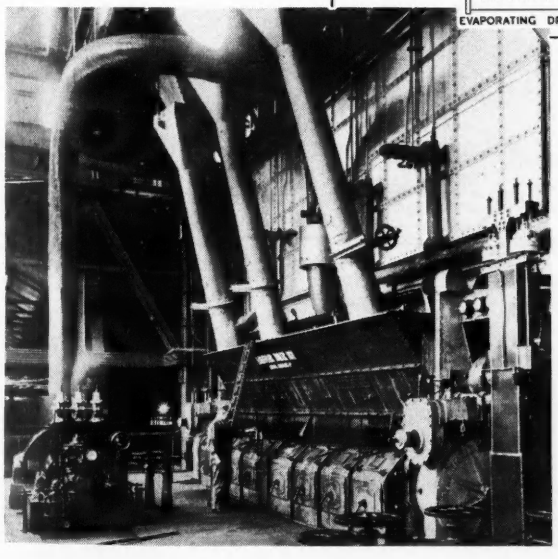
THE Brimsdown "A" power station of the North Metropolitan Electric Power Supply Co., Ltd., as it is to-day, represents great advances in power station work because, first, it is a completely reconditioned station, and, secondly, because the new boiler main plant and generating equipment employ the highest steam pressure yet adopted for public supply work in this country. The station was originally established in 1902, and in 1934, when the present reconstruction scheme was commenced, its equipment included eighteen boilers with a total capacity of about 360,000 lb. per hr. and about 23,000 kW of generating plant in five sets.

About half the original boiler house was scrapped, leaving eight of the existing 160 lb. per sq. in. boilers and room for the new feed pump bay. A new boiler house has been erected at the north end of the old boiler house, and this lofty structure, 108 ft. to the roof, has the unusual construction of reinforced corrugated asbestos sheeting of trough section on steel-girder framework. In it have been installed two 210,000 lb. per hr. all-welded boilers of the Loeffler type (with modifications which afford higher safety factors), which are now operating at 2,000 lb. per sq. in and 910 deg. F.

All the existing main plant in the turbine room has been replaced by a generating unit with a total capacity of 53,000 kW, which includes the two main alternators—18,000 kW on the high-pressure turbine, and 31,000 kW on the low-pressure turbine—and AC and DC house generators. The low-pressure turbine utilises the exhaust from the high-pressure machine, and in the event of emergency will produced 22,000 kW from steam fed through reducing valves or from the existing eight l.p. boilers. One of the old boilers is used for starting up the new h.p. boilers, which are of the forced-circulation type, in which live steam (68.5 per cent.) is injected into the evaporation drums for the production of saturated steam.

The "A" station viewed from the pulveriser house roof of the "B" station





Left: No. 11 boiler with its steam circulating pump

Above: Arrangement of Loeffler boiler

High thermal efficiency is, of course, the object of installing such h.p. plant, and it is expected that over 30 per cent. will be attained. Already on a week's run 29.25 per cent. has been reached. The designed efficiency of the boilers is 89 per cent., and the designed steam consumption, including steam used by the circulating pumps and steam reheater, is under 7.75 lb. per kWh at m.c.r.

Stoker-fired grates, each measuring 25 ft. wide by 23 ft. long, are capable of dealing with 10 to 13 tons of coal per hour. The coal-feeding arrangements are normal. That is not the case with other aspects of the boiler, however, and to see the evaporating drums under the firing floor—that is, at the ash basement level—took some getting used to. The combustion chamber is in the normal position, but it is a lofty structure measuring 29 ft. 6 in. by 26 ft. by 19 ft. in height. The front and rear furnace arches are of the "Longenecker" type with the tiles so supported (threaded on racks) as to permit easy replacement. The roofs over the combustion chamber and over the flue gas reheater and the front suspended wall of the convection superheater are of the "Karrena" type, which permits easy breathing and prevents infiltration of air.

Radiation superheater tubes comprise the walls of the combustion chamber, and all of the six headers for these tubes are outside the combustion space. The steam inlet to the front header is at the centre, and the steam passes thence through the tubes forming the front roof and rear wall linings to the rear header situated above the stoker jamb. To the rear header are connected two side lower headers, and from each of these steam flows vertically upwards through tubes forming the side wall furnace lining to the upper side

outlet headers and thence to the convection superheater. This is situated immediately above the back part of the combustion chamber, and consists of two inlet and two outlet headers interconnected by superheater coils.

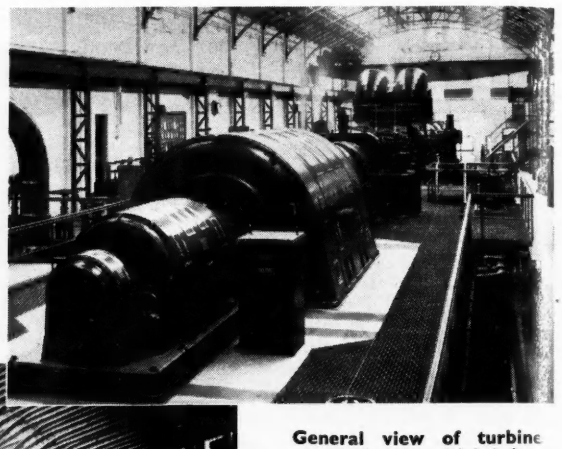
The headers are parallel to the side casing of the boiler, and the coils are arranged transversely in the path of the gases leaving the combustion chamber. Steam enters at the front of the two lower inlet headers, and the coils are so arranged that the steam flow traverses the gas path five times. The steam entering by the left-hand lower header leaves by the right-hand upper header and vice versa.

In front of the convection superheater and immediately above the furnace is a dust hopper, and above this a gilled tube economiser in four banks. Above the convection superheater and at the back of the main portion of economiser is the flue-gas reheater, and above the whole are the air heaters and forced-draught and induced-draught fans. All the integral piping in the boiler was oxy-acetylene welded together on site, and where it was necessary to use flange joints on the high-pressure steam and feed lines these are of the spigot and socket type, with soft-iron joint rings of convex cross-section. All the high-pressure piping is of chrome-molybdenum steel, and the feed lines are of carbon steel.

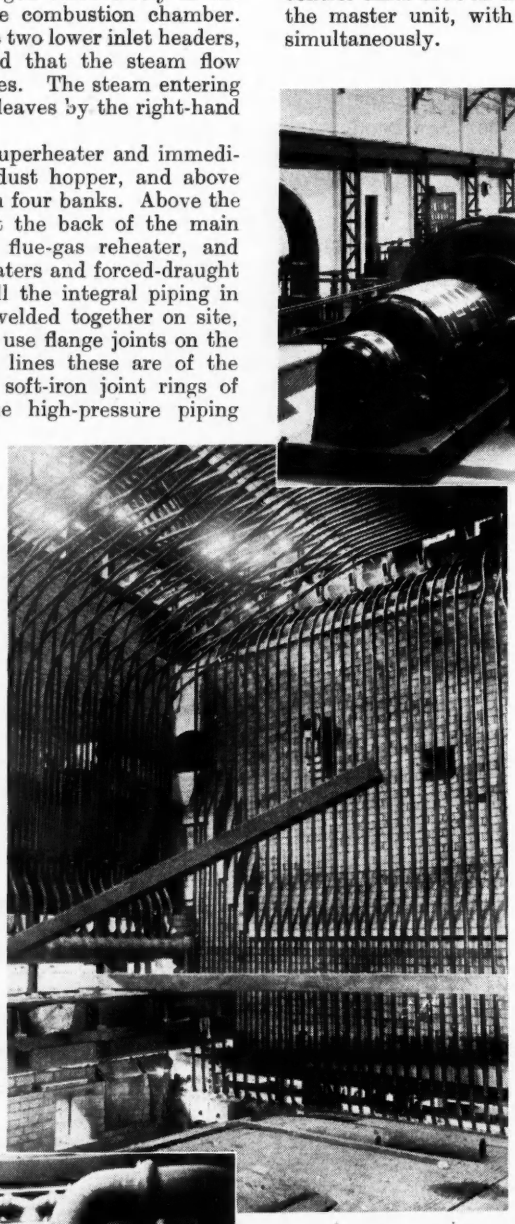
The boiler stop valves are of the "Vitkovice" gate type, and the turbine stop valves are of the centre-pressure pattern.

The "Vitkovice" valve is fitted with a disc carried in a sliding body connected to the operating spindle through a mechanical linkage system whereby in the closed position the valve is held tightly on its seat against the boiler pressure. The linkage is such that on opening the valve the disc is first drawn from the seat, and subsequently, through a system of rollers, a slide body is raised into the main valve body, presenting a parallel path machined in the lower portion of the slide body to the flow of the steam.

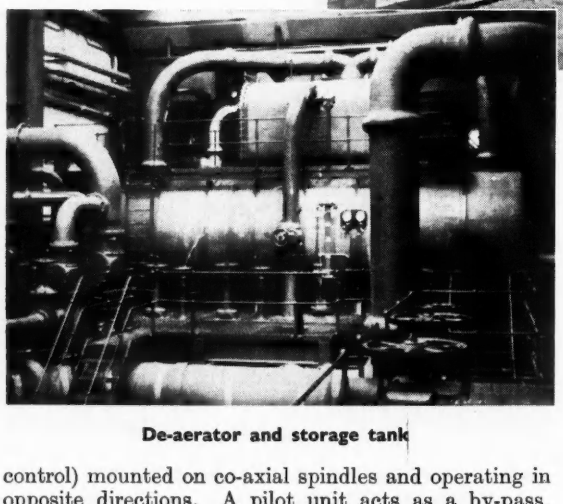
The centre-pressure valve embodies two independently operated units (master and control) mounted on co-axial spindles and operating in opposite directions. A pilot unit acts as a by-pass, and a leak-off unit communicating with the chamber between the two seats automatically prevents any pressure accumulation between the master and control valves. The master unit automatically opens or closes before the control unit, so that it is not subjected to the scoring action of the steam. In operation the master unit opens first, and with it the leak-off unit closes simultaneously. The pilot unit opens next and then the control unit. When closing, the pilot and control units shut in the order mentioned, followed by the master unit, with which the leak-off unit opens simultaneously.



General view of turbine room showing (right) h.p. set from electrical end



Side and rear radiant superheater tubes of No. 2 boiler



De-aerator and storage tank

A special feature of each boiler is the water gauge. A steel float filled with water vapour at the working temperature operates in a float chamber connected to the steam and water spaces of the drum and transmits its motion through a vertical steel ribbon running over a pulley to a permanent magnet housed in a vertical bronze tube of the indicator. As the water level increases or decreases the magnet rotates coloured sectors of the indicator scale, the resulting change of colour, blue to white, thus indicating the water level. The evaporators are 3 ft. 7 in. in dia. and 27 ft. 4 in. long

The high-pressure turbine is a two-cylinder 13-stage impulse machine running at 3,000 RPM. The first cylinder and its two steam chests are made from solid 0.5 per cent. molybdenum steel forgings. For the 12-stage intermediate-pressure cylinder cast steel is employed. The turbine drives, in addition to the 18,000-kW 33-kV main alternator, a 1,650-kW 415-V house alternator and its exciter.

The low-pressure turbine is also of the two-cylinder impulse type running at 3,000 RPM. The first cylinder is of cast steel except for the exhaust portion, which is of cast iron, as is the double-flow final cylinder of five stages (ten wheels).

Direct coupled to the 31,000-kW alternator is a set of gears driving at 1,000 RPM two 1,050-kW 0-500-V DC generators and an exciter for the two main alternators with its pilot exciter. A standby motor-driven exciter has also been installed. Both main alternators are designed to generate at 33 kV and have a reactance of 20 per cent.

They are normally controlled as one unit by an outdoor-type 33-kV oil switch, with an oil-immersed isolator in

each alternator circuit. The station is controlled electrically from Brimsdown "B" station.

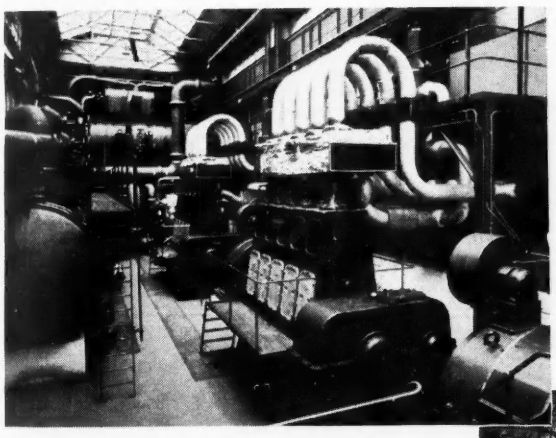
The Steam Cycle

Evaporated steam from the boiler drums (three per boiler) is passed to the steam-driven steam-circulating pump, which consumes 13,000 lb. of steam per hour. The speed of this pump is varied according to the required circulation through the boiler tubes, as dictated by the output and the required steam conditions. The h.p. saturated steam is then passed through the radiation superheater and thence to the convection superheater, from which it goes to the h.p. turbine, where the stop-valve conditions are 1,900 lb. per sq. in. and 930 deg. F.

The exhaust from the h.p. turbine (244 lb. per sq. in., 476 deg. F) can be passed through a steam reheater to bring its temperature up to 570 deg. F., and then through the flue-gas reheater, which it leaves at 820 deg. F. for delivery to the l.p. turbine at a pressure of 201 lb. per sq. in. So far it has been unnecessary to use the steam-to-steam reheater. The l.p. turbine has two condensers, each capable of dealing with 294,000 lb. of condensate per hour, with an exhaust vacuum of 28.5in. Hg., when supplied with 32,000 gal. of cooling water per min. Each has a cooling surface of 19,500 sq. ft., comprising 5,533 tubes of $\frac{3}{4}$ in. outside diameter.

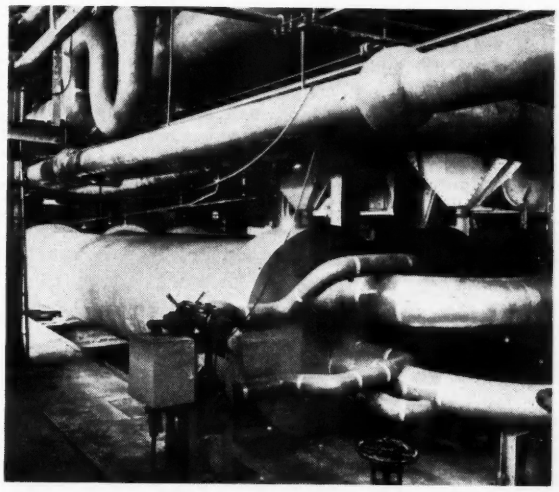
The condensate is pumped by one of two extraction pumps to a drain cooler, from which it passes to an evaporator condenser and, in turn, to a gland heater and de-aerator, where the entering temperature is about 170 deg. F. From the de-aerator storage tank the water is then pumped to h.p. heaters, Nos. 1 and 2 of which are supplied with steam bled from the l.p. turbine, No. 3 with steam bled from the exhaust of the h.p. turbine, while No. 4 takes as its heating medium the h.p. drain from the steam re-heater (22,400 lb. per hour). The feed water now passes to the suction of the main feed pumps at 362 deg. F. and 325 lb./sq. in.

These pumps are of the vertical five-throw reciprocating type with water-cooled cylinders. They are gear-driven by 800-HP variable-speed DC motors at 100 RPM when delivering 240,000 lb. of water per hr. On test their efficiency (including gearing) came out at approximately 89 per cent. at full load, which was maintained very closely down to quarter load, whereas a centrifugal pump gives 60 per cent. at full load and 24 per cent. at quarter load. A standby steam turbine-driven 4,000-RPM pump is also installed.



Main feed pumps and evaporators

The feed pumps deliver the water to the economiser at 2,200 lb. per sq. in., and at this pressure it is passed on to the evaporating drums at 530 deg. F., thus completing the cycle. Make-up feed water is taken from town supply and evaporated. The steam-driven auxiliaries are supplied from a receiver which is normally fed by a tapping off the outgoing steam from the steam reheater to the flue-gas reheater. For use in the case of failure there are two Escher-Wyss reducing valves, which receive steam from a tapping off the main radiation headers. Normally these reducing valves do not function until the pressure on the auxiliary system has dropped to 85 lb. per sq. in. The steam-driven auxiliaries are



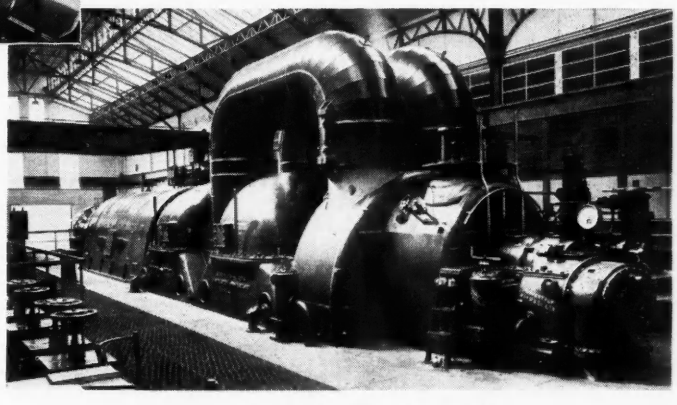
Evaporating drums of one of the boilers

the h.p. steam-circulating pumps, the main standby feed pump, the standby lift pump, and the seals for the h.p. and l.p. machines.

Central Boiler Control

Turbine auxiliaries, c.w. pumps, and secondary-air fans are driven by AC motors, all direct started, control gear above 5 HP being of the air-break contactor type. All the normal boiler regulating auxiliaries are driven by DC motors, which, by virtue of Ward-Leonard control, can be governed from the central boiler control board in such a manner that the two boilers can be regulated together as one unit, or each auxiliary may be controlled individually. On each of the two boiler panels are rheostats for the separate units and a control for the whole, and there is a separate master control for both boilers. Important auxiliaries have no-volt releases. Only the four largest motors are controlled directly from the works power switchboard, the others being supplied from pillars through h.r.c. fuses.

From the coal stocks of Brimsdown "B" station or from wagon tipplers, a main belt conveyor in a covered-in gantry and capable of handling 120 tons per hour conveys the fuel to the bunkers in front of the two h.p. boilers. By using the existing gravity bucket conveyor and the belt conveyor in the l.p. boiler

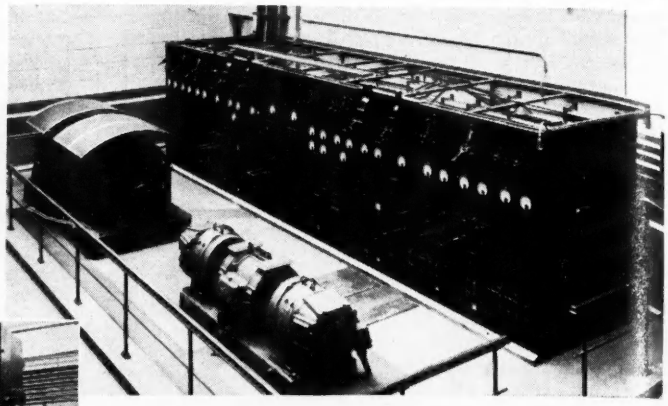


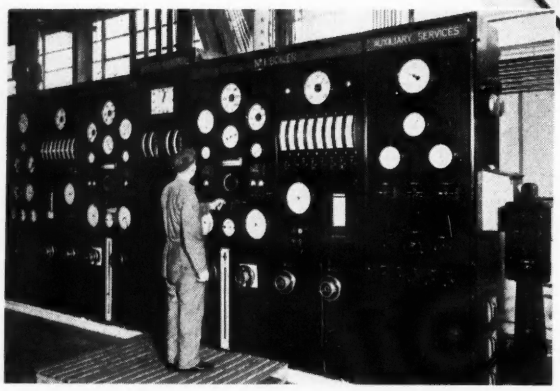
Low-pressure set from steam end

house coal may be supplied from the adjacent River Lea. In this case a Redler conveyor passes the coal from the l.p. boiler house conveyor to the conveyor

over the bunkers. In the direct path from the bunkers to the boiler stokers are Avery 5-cwt. gravity-operated weighing machines. There are two forced-draught and induced-draught fans per boiler situated on a fan-floor above the boilers. The f.d. fans discharge the air through the air heaters to the stokers with an entering temperature below the grate of 332 deg. F.

In the basement there is also a secondary-air fan (one per boiler), which sucks air from the main forced-draught ducting, and discharges it through nozzles over the grate at the front of the boiler. Between the inlet scroll and the inlet eye of each fan there is a "Vortex" collector. At suitable points on the periphery of the inlet scroll are arranged slots to entrain a portion of the gases, which, being in the outer radial path of the flow, contains, by virtue of centrifugal action, a large proportion of the dust content of the gases. The gases so entrained are passed to the collector on the fan floor. The dust-free gas is returned from the lower portion of the vessel to the inlet eye of the fan. The collector discharges its dust to a receiving hopper at the basement level.





Left: Boiler control board. Above: Auxiliary DC board and Ward Leonard and booster sets for auxiliaries

Two main motor-driven vertical circulating pumps at the north end of the turbine room receive from, and discharge to, two concrete cooling towers the condenser-cooling circulating water. These towers will each cool 1,050,000 gal. of water per hour from 83.5 deg. F. to 70 deg. F. when the dry bulb temp. is 60 deg. F. and humidity 75 per cent. A considerable proportion of the works power is accounted for by the c.w. system, but the calculated total comes to only 5.4 per cent. at economical rating.

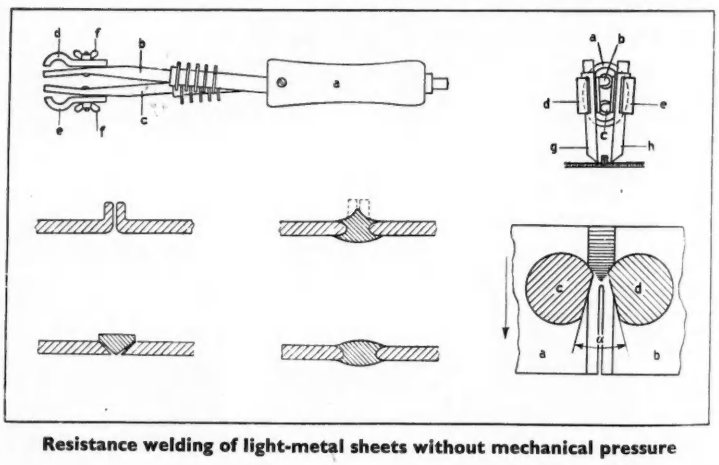
The principal contractors were: Babcock & Wilcox, Ltd., ash-handling plant; Davidson & Co., Ltd., dust plant; Film Cooling Towers (1925), Ltd., cooling towers; Hopkinsons, Ltd., valves and fittings; James Howden & Co. (Land), Ltd., draught plant and air preheaters; International Combustion, Ltd., stokers; Mavor & Coulson, Ltd., coal-handling plant; Metropolitan-Vickers Electrical Co., Ltd., turbo-alternators, condensing plant, feed heaters and evaporators, auxiliary generators, motors and control gear, including Ward-Leonard system; Mitchell Engineering Co., Ltd., boiler plant; A. Reyrolle & Co., Ltd., works-power metal-clad switchgear; Senior Economiser Co., Ltd., economisers; Stewarts & Lloyds, Ltd., station piping; G. & J. Weir, Ltd., lift and feed pumps. The pictures for this article were taken by our own photographer.

Welding Thin Light-metal Sheets

GAS-TORCH and electric-arc fusion-welding, and electric-resistance welding with application of mechanical pressure are all applied to the joining of relatively thick plates of aluminium alloys or other light metal alloys, but the satisfactory and economical welding of these materials in thicknesses less than 0.03 in. has hitherto been a matter of considerable difficulty. The accompanying illustrations from an article by K. G. Gabler in the *V.D.I.-Zeitschrift* relate to a modified resistance-welding method, developed by the Swiss engineers A. and H. Weibel, the essential feature of which is the use of electrically heated carbon tongs to bring flanged edges or a filler strip to welding heat. The joint is completed by fusion, without the application of mechanical pressure, the action being similar in this respect to autogenous welding by gas torch.

Referring to the upper illustrations, an insulating handle *a* carries a fixed rod *b*, and a lower rod *c* which is rotated when the handle is gripped, thus moving apart the tips of the carbon electrodes *g*, *h* clamped by the plates *d*, *e* and the wing nuts *f*. The ends of the electrodes are chamfered as shown; the axes of the electrodes are inclined slightly to the vertical, and the flattened faces of the rods are set at a small angle α, opening in the direction of welding. The edges of the sheets to be joined are flanged; or they may be bevelled, in which case a filler strip of the same material is applied. The sheets are held in position, a short distance apart at the joint, by any convenient form of clamp.

Supply is taken from AC mains through a step-down transformer. From 200 to 500 A at 4 to 9 V is required in the electrode circuit. The tongs are first held with the tips of the carbon rods in contact until they have reached bright red or white heat, according to the material and thickness of the metal to be welded. The tongs are then opened and the hot tips of the electrodes are applied to each side of the flanges, or filler strip. The metal is melted locally, effecting a fusion weld, and the tongs are moved steadily along the line of the joint, which is completed at the rate of 24 to 40 in. per min. Owing to the local nature of the heating, no distortion troubles are experienced. The structure of the weld metal is fine and uniform, and corrosion tests reveal no sign of local attack.



Resistance welding of light-metal sheets without mechanical pressure

SHORT-CIRCUIT POWER FACTOR

Its Effect on the Rating of Low-voltage Circuit-breakers

By C. J. O. Garrard, M.Sc., A.M.I.E.E.

IT has now become a commonplace that the maximum capacity, expressed in MVA, for which it is economically possible to build a circuit-breaker decreases as the system voltage is decreased. That is to say, the maximum economic breaking-capacity current remains more or less constant whatever the voltage.

While this is true as a general principle, low-voltage breakers are to some extent an exception, inasmuch as breaking-capacity currents which are common at 400 V are comparatively rare at 11 or 33 kV. Thus a capacity of 25 MVA at 400 V, corresponding to a breaking current of 36 kA, is quite usual. At 11 kV this current corresponds to a capacity of roughly 750 MVA, which is quite large for that voltage; at 33 kV it would involve a breaking capacity of 2,250 MVA, which at present is quite unknown at that voltage, and moreover never likely to be required. On extended low-voltage networks of large power symmetrical fault currents exceeding 40 kA are not unknown.

Arc Length and Voltage

In general, therefore, the switchgear designer has to deal with larger breaking currents at low than at high voltages. This would not give rise to any serious difficulty if for a given breaking current the arc energy released in the circuit-breaker during operation decreased in the same proportion as the voltage.

This, however, is not the case, because, as experience shows, the arc length in plain-break circuit-breakers (as practically all low-voltage breakers are at present) does not decrease proportionately with the voltage to any great extent below a minimum of about 6.6 kV. The reason for this is probably that in an oil circuit-breaker the means for extinguishing the arc is generated by the arc itself so that a certain minimum arc length is necessary to produce sufficient movement in the oil to have an adequate quenching effect.

The voltage drop per unit length of arc is practically independent of the current at the very high currents which are here being considered. The result is that the liberation of energy in a low-voltage breaker is greater in proportion to its MVA capacity than that in a high-voltage breaker for the same breaking current.

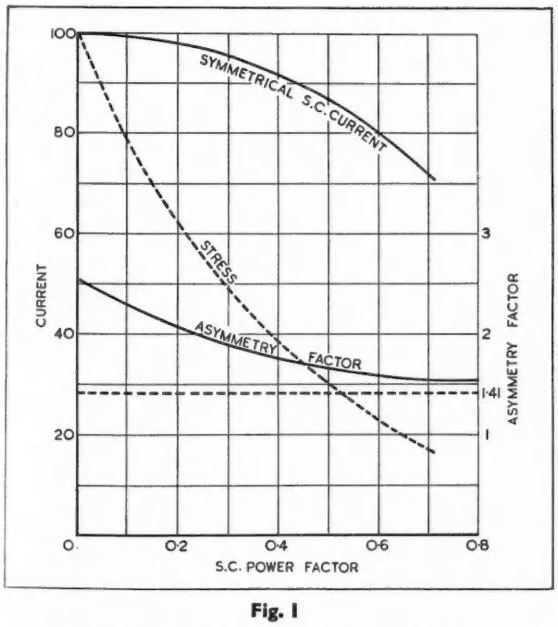


Fig. 1

A further increase in the severity of the duty arises from the difficulty, if not impossibility, of ensuring that if the breaker is closed upon a fault the contacts will make cleanly and without arcing, particularly when they have been burnt by a previous operation.

However quickly the tripping gear may operate, a delay of several half cycles must elapse between the instant when the fault current first begins to flow and the parting of the contacts and the extinction of the arc. The arcing which may take place during this interval increases the rise of pressure in the tank. The same effect is, of course, observed in high-voltage breakers for both large and small breaking currents; here, however, the comparatively much greater size of the breaker enclosure reduces its importance, although it may have to be guarded against in the design of arc-control pots for large capacities. These effects of the high fault current operate in addition to the more generally recognised electro-magnetic forces and, in common with these, are intensified by the increase of the peak fault current caused during the first few half cycles in which it flows, by "doubling" or asymmetry of the short-circuit current. The stress upon the breaker is thus considerably affected by the amount of asymmetry in the fault current, and the time for which the asymmetry is maintained. Both these variables are determined by the power factor, that is, by the proportion of resistance to reactance in the short circuit path.

Mr. C. J. O. Garrard

Resistance of Short-circuit Path

Mr. R. T. Lythall has pointed out in the ELECTRICAL REVIEW (November 18th, 1938) the importance of not neglecting the resistance of the short-circuit path in calculating the fault currents in low-voltage systems. While observing correctly that the presence of resistance may reduce the symmetrical fault current to an important extent, he neglects the much greater extent to which this resistance may reduce the duty upon the circuit-breaker by diminishing the degree of asymmetry in the fault current and the time during which the asymmetry persists.

Considering fig. 1, suppose that one has first a purely reactive short circuit, such that the short-circuit current has a value that is denoted by 100. The degree of asymmetry is in this case a maximum, and the initial peak value of the short-circuit current is theoretically twice the peak value of the symmetrical current, or 2.82 times its RMS value. At the lowest power factors met with in practice this factor approaches 2.55 and for this reason the value 2.55 is given, for instance, in B.S.S. 116—1937.

Suppose further that resistance is added gradually to the circuit so that its power factor rises from zero to about 0.7. The first effect is that pointed out by Mr. Lythall, namely, that the symmetrical short-circuit current is decreased only, however, to a comparatively small extent. In practice the power factor is seldom likely to exceed 0.5 (except at the ends of long feeders of small cross-section); the addition to the existing reactance of the amount of resistance corresponding to such a power factor does not greatly increase the impedance.

The effect upon the degree of asymmetry is, on the other hand, very marked. This is shown by the curve representing the value of the "asymmetry factor," that is, the factor by which the symmetrical RMS fault current must be multiplied to obtain the initial peak-fault current. The magnitude of the factor falls very rapidly, soon approaching 1.41, which is the ratio between the peak and RMS values of a sine wave.

As the time during which the asymmetry persists decreases in the same proportion as its initial value and the electromagnetic forces decrease as the square of the peak current, the stress upon the breaker must decrease in some such manner as that indicated by the dotted curve.

Effect of Power Factor upon Rating

The conclusions drawn from the above arguments are confirmed by the results of testing breakers in short-circuit testing stations.

In the (it is to be hoped now only temporary) absence of a

relevant standard specification it is customary to carry out short-circuit tests upon low-voltage breakers at power factors approaching those specified in B.S.S. 116 for high voltages, *i.e.*, 0.1 to 0.15. The result is that in such tests the theoretical maximum making peak current corresponding to a given symmetrical fault current is approached.

It is found that if the power factor of the test circuit is increased, and the value of the asymmetry factor in consequence reduced, the maximum symmetrical fault current for which a given breaker can be rated is also increased to such an extent that the initial peak current again assumes its original value. In other words, the initial peak current and not the final current actually broken is the limit of the capacity of the breaker.

From this it follows that, on systems below 660 V, the initial peak value of the short-circuit current forms the main criterion of severity and not the symmetrical value as in the case of high-voltage breakers. In calculating the fault current the peak value should be determined by multiplying the symmetrical value (obtained by the usual methods, not forgetting the effect of circuit resistance) by the asymmetry factor appropriate to the power factor of the circuit. Suitable values of this factor in terms of the ratio between resistance and reactance in the circuit are given in Table 1. A breaker should then be chosen that will deal with the initial peak current so calculated.

Reference to fig. 1 and to the discussion above will show that the breaker so chosen will in many cases be considerably smaller and cheaper than one chosen solely with regard to the symmetrical fault current to be expected.

Circuit-breaker Resistance

Another point to which it may become profitable to direct attention is the influence upon the value of the initial peak current of the circuit-breaker itself. When a breaker is closed upon a heavy fault it is seldom that no arcing at all takes place at its contacts. The result of this arcing is, in effect, that the resistance of the fault path is increased, so that the value of the initial peak current and of the symmetrical current is reduced. This effect is produced both when the breaker is operating on a network and in a testing station, and the reduction in the severity of the operating conditions consequent upon the action of the breaker itself is the same in either case.

It follows that as the initial fault current in the network is calculated without any allowance being made for the reduction of the current by the resistance introduced by the breaker itself, this should be credited on test not with having dealt with the peak current actually measured during the test but

TABLE I.

R/X	Asymmetry Factor
—	1.8
0.1	1.6
0.2	1.45
0.3	1.34
0.4	1.26
0.5	1.2
0.6	1.16
0.7	1.12
0.8	1.1
0.9	1.08
1	1.06

with the peak current that would have flowed had the circuit breaker been replaced by a connection of negligible impedance.

That is to say, the same procedure should be adopted as is admitted in the case of fuses; low-voltage breakers should be rated on the basis of the *prospective* initial peak short-circuit curent with which they will deal.

Theory of Photography

THE twenty-ninth annual May lecture of the INSTITUTE OF METALS was delivered in London on Wednesday by Dr. Olaf Bloch (chief chemist, Ilford, Ltd.), who commenced his discourse with a demonstration of high-speed infra-red photography.

The lecturer said that photographic emulsions consisted of finely divided suspensions of one or more of the halides of silver in gelatin, and there were two broad theories of development, but they were still without definite proof of the nature of the latent image. Exposure was believed to liberate electrons from bromine ions. They moved in the crystal lattice structure, giving rise to photo-conductance and when they came into contact with specks of silver or silver sulphide they were held fast. The silver or sulphide became negatively charged and could then attract silver ions which were also free to move in the crystal lattice. When the nucleus became sufficiently large by attachment of silver brought about in this way the grains became developable.

Here and There

By "Nomad"

MY concluding remark last week that "it is the insufficiency of plug points that is probably the most handicapping factor in domestic development to-day" has brought forth some bitter remarks from one of my readers regarding the obstructive attitude of electricity supply undertakings towards this problem. "What," he says, "do some supply undertakings do to encourage the provision of extra plugs? The one I have to deal with states that its meter rentals are regulated by the "connected load," but, in fact, they are not. An arbitrary value is assigned to each plug and the meter rental is based on that—not on the actual load constituted by the appliances connected or connectable. In my own case with an actual connected or connectable load of under 4 kW the meter rent is as for 12 kW (six plugs at 2 kW each), thus putting me in a higher range of charge. Such petty exactions do not encourage consumers to put in more plugs, as by doing so they are merely making a scourge for their own backs. At the best, meter rents are an impudent ramp. I am told some of the less grasping suppliers have abandoned them, but I fear they are in the minority."

* * *

My correspondent can comfort himself that he is not alone in his dislike of meter rentals. No one can be expected to relish paying out money for a piece of apparatus for which he personally has no use and which is installed purely to assist the supply undertaking to know how much to charge him. If he has to pay for it, surely it is better for the charge to be concealed or disguised in some way. Charging separately for a meter is just about as logical as including in the account a separate item for the meter reader's boots!

In spite of what my correspondent says it is a fact that more and more undertakings are beginning to realise the truth of this, and are finding ways and means of abolishing meter rentals. I have a feeling that more still would have followed their good example, but for the fact that "No meter rental" is usually a potent "selling point" employed to induce consumers to adopt the two-part tariff in preference to the flat rate. The wisdom of this is questionable and I am not at all sure that the psychological value of a scale of tariffs in which meter rents have been dispensed with entirely is not worth a good few consumers on the two-part tariff. The two-part rate will be adopted soon enough when consumers begin to appreciate fully the advantages of electricity. But let them have this chance and let them feel they are getting a square deal.

* * *

Actually, however, in my humble opinion, the crux of the matter does not rest in meter rentals. It lies much more in the expense which the consumer has to bear to get new plug points installed in his home—and by plug points I mean ordinary 5 or 15-A outlets for fires, kettles, toasters, lamps, etc., not the more expensive and elaborate points for cookers and wash-boilers. The latter are now, in a very large number of areas, installed free of charge (or perhaps I should say *apparently* free of charge, for, of course, the cost is recouped from the hire or hire-purchase charges for the apparatus), provided that an agreement is signed to use the apparatus for usually about three years.

Consumers wishing to use smaller pieces of equipment are not so well catered for in the matter of suitable outlets. Assisted wiring schemes are, of course, often available, but these never strike me as being over-generous, while as to the cash charges made by supply undertakings for installing extra points they are often sufficiently high either to scare the consumer off altogether or, failing that, make him, if he is persistent enough in his demands, to have recourse to an inferior installation undertaken perhaps by someone without qualifications or knowledge of how to make a safe and efficient job.

* * *

I gathered one interesting little piece of news when I looked in at the London showrooms of the General Electric Co., Ltd., on Monday. Such an enthusiastic reception has been given to the new "D.100" streamlined cooker introduced last November that the company has decided to bring out a slightly larger model with a bigger oven capacity and two hotplates instead of one. As in the case of the "D.100," the new cooker will be designed for thermostatic oven control, though this feature will be optional.

Incidentally, I noticed that all the thermostats fitted to G.E.C. cookers now conform with the E.D.A. recommendations regarding calibration, namely, the marking of the scale in degrees Centigrade with the hundred digits larger than the others. Till recently, you will remember, the thermostats on G.E.C. cookers had an arbitrary scale running from 0 to 10.

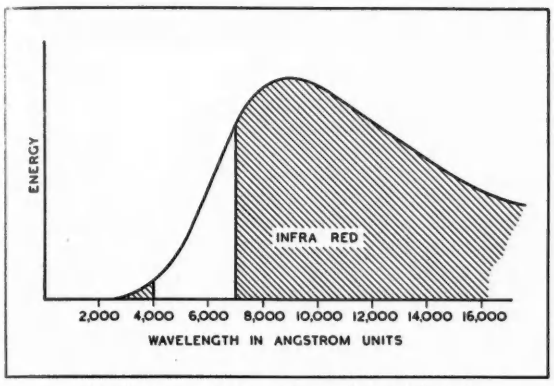
BLENDED LIGHT

Its Commercial Applications

By A. H. Olsen, B.Sc., A.C.G.I., A.M.I.E.E.

THE introduction of discharge lamps has brought a new technique into shop lighting. In most of the main town shopping centres blended light installations become very apparent as the brilliance of illumination in the windows presents a striking contrast to competitive windows in the same area; also the values of the displayed goods are enhanced owing to the sharpness with which they appear. This new form of advertisement is being greatly appreciated by most shopkeepers, and it can be safely said that blended light will be adopted by many as an additional form of publicity in the future.

The term "blended light" is used to describe the mixture of the ordinary tungsten gasfilled lamps with mercury-discharge lamps. A gasfilled lamp depending upon the heating of a tungsten filament emits light with a continuous spectrum having a predominance of red amounting to 30 per cent. but lacking blue, the resultant colour being yellowish, whereas a mercury lamp, depending upon the excitation of vapour, emits a light with a broken spectrum with an almost complete absence of red light and a predominance of blue. If the two light sources are mixed appropriately it is possible to obtain a white light and arrive at conditions approximating to daylight.



Continuous spectrum (incandescent lamp)

An 80-W mercury lamp emits 3,040 lumens against only 1,330 lumens by a tungsten 100-W lamp. Hence, to mix lumen for lumen of each light source at least two 100-W tungsten lamps are needed to blend with the 80-W mercury lamp. An 80-W mercury lamp is to be preferred to the larger sizes for shops owing to the amount of tungsten required for blending, and also owing to the dimensions of lamps, greater output tending to make the size of reflector rather large.

Correct Proportions

Effective application of blended light to shop windows depends upon various factors and the proportions of the two types of light is dependent upon the type of goods to be displayed. No definite amounts can be fixed and each installation has to be treated on its own merits.

If colour correction is essential, as in the case of drapers, furnishers and outfitters, where fabrics are displayed, the proportion of tungsten lumens is generally in the neighbourhood of three to one; in practice, this means utilising one 80-W mercury with two 200-W tungsten lamps in order that the colours may be shown in their true light. Black tends to take on a richer tone and red shades do not appear mauve as they would under mercury light.

Other types of windows do not require such a high standard of blending. For glassware, jewellery and china, the balancing of lumen for lumen of each light source is sufficient as colour is not of primary importance.

In low windows the blending should be at the source and the trough, obtainable in rectangular form of various designs, is the only practical housing for the twofold lighting source. Some diffusing medium for blending the light mixture before it is brought into the window is also required. This usually consists of a glass of the "stippolyte" variety owing to its low absorption value. Flexibility can be obtained by the use of trough fittings as the proportions of the two light sources can be varied inside the trough to suit with the type of goods displayed.

With high windows, conditions are a little different if the lighting fitting can be hidden behind the transom or pelmet and if the displayed goods are not dressed high at the front of the window or are of such a nature that colour correction is not important. The tungsten and mercury lamps can be housed in different reflector units, these being of the ordinary silvered angle type and so arranged that the mercury unit is placed with a tungsten unit on either side.

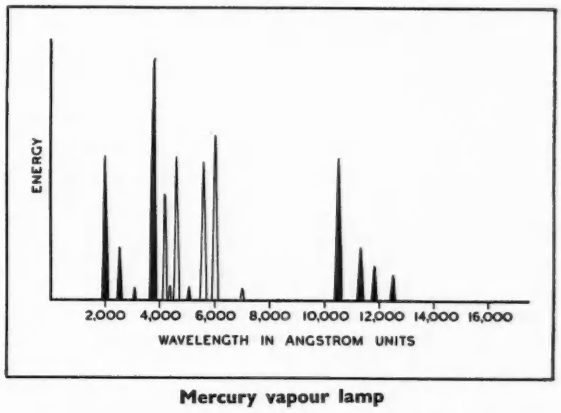
Existing window installations have been adapted to the use of blended light by this means, but the results obtained are generally patchy, chiefly due to unsuitability of the windows and to insufficient thought having been paid to their height and depth when the goods displayed require high colour correction. Such installations do a good deal of harm to the trade as they are apt to prejudice people against blended light.

A great advantage of blended light for deep windows is that if the reflectors are splayed, there is no need to augment the lighting at the rear of the window owing to the penetrating powers of blended light. Windows with a depth of 10 ft. are found to be well lighted and the difference in intensity on the rear enclosure does not appear to vary. A trough fitting of large dimensions, such as 24 by 18 in., is to be preferred to a smaller one, say, 24 by 12 in., as it furnishes a more even illumination.

Consumption and Efficiency

Although the consumption of electricity might be expected to be lower than for a normal installation using tungsten lamps only, in practice it is found that owing to the amount of tungsten required to blend with the mercury, the final consumption figures are approximately the same. The added efficiency of the blended installation is in the neighbourhood of 20 per cent., however, depending upon conditions such as background colours and type of goods displayed.

A blended installation employs less than half the number of lighting units required for a normal tungsten installation but there is a much greater concentration of heat round the units. Ample ventilation must, therefore, be provided and co-operation with the shopfitter is essential so that ducts may be placed in the windows to allow a free circulation of air. If there is a false ceiling, inconspicuous ventilation holes must be arranged at regular intervals.



Mercury vapour lamp

Co-operation with the builder and architect also is necessary in the design stages of the installation in order that troughs may be recessed in the ceiling (access to them being obtained by means of a diffusing glass incorporated in a hinged panel), that suitable colour backgrounds may be provided and that all wiring may be concealed.

The lighting of island windows presents a difficult problem. With tungsten lamps the method of hiding the light source has been the use of louvres in circular reflectors; alternatively, an illuminated glass ceiling forms a miniature laylight, but this has never been really successful as the brilliance of light is absorbed by the glass and hence the goods are inclined to appear rather flat and uninteresting. Blended light, however, necessitates the use of troughs for mixing it

at the source, also a diffusing glass panel arranged flush with the false ceiling. Another problem arises due to the high surface brightness of the glass, but a decorative metal louvre incorporated with the diffusing glass will overcome this. The glass and louvre should form one unit to facilitate access to the troughs.

Chokes, if mounted on the reflector units, save wiring and give more flexibility. Heat-resisting flexible cables should be used for wiring the trough. The question of installing a condenser for each trough will have to be decided on the merits of the case. It is cheaper to install one condenser at the fuseboard to correct all the lights in one window, but this has the disadvantage that at half load over-correction occurs resulting in reduced power factor. In large stores where there are other loads, some of them lagging, this does not matter, but normally there is only a heating and lighting load, which is non-inductive.

The cost of an installation of blended light as against that of using ordinary tungsten lamps is roughly 50 per cent. greater providing the two wattages are approximately the same, variations in this figure depending upon local conditions.

Interior illumination provides a different problem, the result being largely dependent upon the fitting to be employed and this will have to be of rather large dimensions in order to accommodate the discharge lamp as well as the tungsten lamps. Moreover, the surface brightness of the unit will have to be limited in order to avoid glare.

Manufacturers have not made much progress in this direction, as the units available at the moment are of the plain enclosed opal type, such as the sphere and variations of the ordinary commercial units. There is nothing in the decorative line, which is a great pity, for owing to the high initial cost of the discharge lamp units and apparatus, large stores would naturally be prepared to pay a little more for a decorative unit.

Indirect lighting has not been utilised much up to now in the blended light form, but it is likely to become more popular in various types of units, such as wall brackets and recessed louvre fittings. Lay lighting is also improved by the use of blended light as the added brilliance overcomes the flatness of diffused tungsten light.

In carpet showrooms and other showrooms where there are fabrics and materials that absorb the light, blended light would go a long way to improve matters, besides giving a more cheerful outlook.

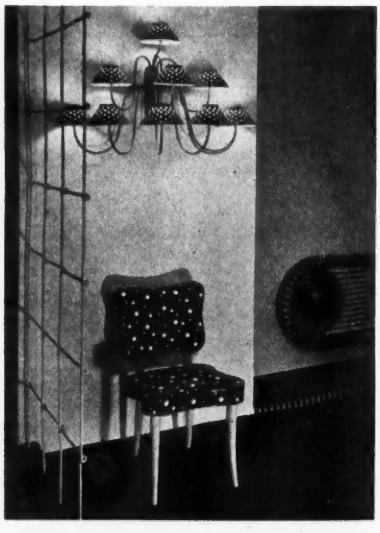
The advent of fluorescent discharge lamps in smaller sizes will prove a great boon as the correction required is far less since the proportion of red rays is increased from approximately 1½ to 6 per cent. The larger dimensions of these new lamps will not matter greatly in new window installations where the lamp is placed in a trough, but in existing installations, where silvered angle reflectors are used, difficulties will be introduced owing to the focal point and the length of lamp coming well below the existing reflector. For interior lighting the problem of fittings design will be made much simpler as the space required to house the lamps will be far less since fewer tungsten lamps will be needed.

In conclusion, it may be said that blended light offers a good deal of scope in the commercial world, the quality of light obtainable being eminently desirable. Lamp design is constantly improving and it is impossible to forecast when the discharge lamp requiring no correction will be put forward by the manufacturers but, meanwhile, the correction of the existing lamps presents an interesting and tricky problem for the lighting engineer.

Paris Lighting Display

THIS year's Salon de la Lumière has been combined with the Salon des Artistes Decorateurs, instead of forming a separate exhibition as in past years. It must be admitted that this idea of a combined display of light and interior decoration has much to recommend it. Certainly the combination of the efforts of the decorator and the lighting engineer has resulted in revealing the possibilities of light on a scale which has not been seriously attempted on previous occasions.

Rather oddly, considering this combination of the two arts, the theme chosen for the Light Salon was light in the street. This is displayed in a section of a perhaps rather fantastic, but certainly very effective street, which forms an entrance to the furnishing section. Shops, a theatre, a corner of a park, a bar, and even a costermonger's barrow line the streets, each with suitable lighting. Although this street undoubtedly shows some of the possibilities of light, its practical interest is lessened by the fact that it has been designed and carried out rather too effectively. The street looks rather more like a stage set than like a street.



A fitting designed by Jean Royere employing perforated metal shades

More interesting are some of the ideas which have been introduced in the decoration and light section. Perhaps one of the more unusual ideas is the result of co-operation of the decorator, Jean Royere, and the lighting engineer, Caillat. This room is provided with indirect light coming from one of the walls instead of from the ceiling. The wall is provided with a number of fairly deep cylindrical cavities, painted white internally, and provided with a small reflector and a lamp in the bottom of each one. In this way the light comes by reflection from the bottom and sides of the cavities, and so provides not only an unusual lighting effect but also an interesting decorative *motif*.

Ideas for lighting are sometimes a little theatrical, even for the home. Such a one is that which Arbus has tried in his room "for a summer evening." Light is provided by a number of spotlights placed in the ceiling, and provided with screens which light the room in a pattern of light and shade rather reminiscent of sunlight filtering through trees. A low level of general lighting is provided by wall brackets, and the light of the projectors is calculated, of course, to give good lighting at the points of the room where it will be most needed.

Another theatrical but very effective installation is that devised by Claude Salvy for a "shop on a fête day." This installation combines the spectacular and the practical, by providing general indirect light of a more or less temporary character, in a series of colours which are automatically controlled and interplayed by an installation similar to that used for the operation of electric signs. The colours and the gradations of light are chosen to harmonise with the colour scheme of the shop itself. The practical side of the lighting is provided by "daylight" and ordinary incandescent lamps in small reflectors on the counters.

Effective Colour Design

Still another idea in shop lighting is provided by Collette Gueden of Primavera. A series of small show windows is provided with a separation consisting of screens between the windows which leave a space between the end of the screen and the rear wall, which runs the full length of the series of windows. Coloured lamps in very wide angle reflectors are fitted into the back of the screens, to shine on the rear wall. A different colour of lamps is used in the reflectors of each screen, so that each window has a background in two colours which blend gradually from one side to the other, and give a most effective result.

The display is really a mine of lighting ideas, which is, after all, what it is intended to be. It is interesting to note that the creators of the various displays have tried to use the simplest possible means of obtaining their effects. Ordinary reflectors, small spotlights which can be found at any electrical dealer's, light ramps which any electrician's apprentice can put together, are the materials they have used. One or two decorators have tried to use Wood's light in a small way, and the multi-pole motor driven rotary contactor in Claude Salvy's show is a little out of the ordinary. Otherwise, the Salon is a remarkable display of the limitless possibilities of installations made by the average contractor without any special equipment. As such it is probably the most successful yet organised.

A VISIT TO SWITZERLAND

The National Exhibition

ALTHOUGH we English justly regard Switzerland as the "playground of Europe" it must be remembered that the country has a first-class industrial system. A recent brief visit to the country afforded us no time to play and too little to see all that we would have liked to of Switzerland's industry.

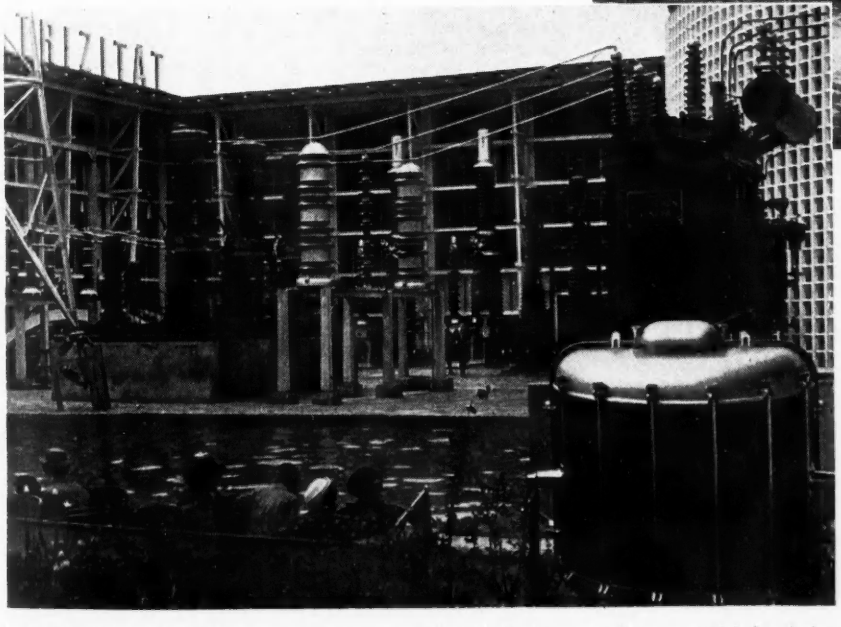
At the invitation of the Swiss Government we joined a Press party whose primary object was to visit the National Exhibition at Zürich which opened a week or two ago and continues until October, but we were also able to inspect some engineering works while we were there. The journey was made by air, occupying only three hours against the eighteen hours of the terrestrial method—a valuable consideration when time is limited. Upon our arrival at Zürich the pilot made a number of turns round the city to give us an excellent opportunity of appreciating the well-laid-out display of Swiss national activity.

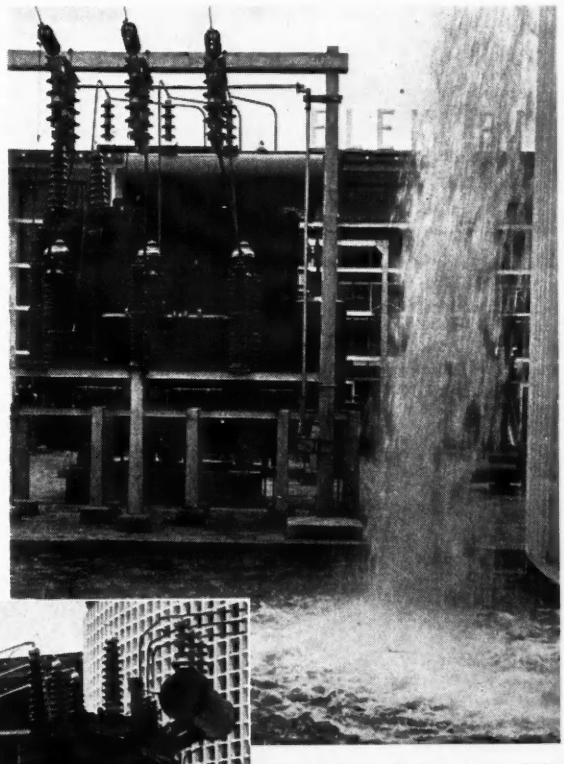
Zürich stands at the northern end of the long lake bearing its name, and the Exhibition is arranged on both shores just outside the city. It is divided into fourteen sections, most of the industrial exhibits being on the right (or Enge) side of the lake, the Riesbach shore on the other side accommodating the pavilions devoted mainly to rural and agricultural pursuits. In all, the Exhibition takes up an area of about 70 acres of which buildings occupy about 30 acres. The cost of erecting and arranging the buildings is estimated at 20 million Swiss francs (nearly £1,000,000 sterling).

We think that the display is about the most informative which we have ever seen. It is logically arranged and the exhibits, supported by diagrams and statistical displays, very effectively illustrate every aspect of the Swiss economy.

The Electrical Display

Attention is drawn to the Electricity Section by a waterfall from the top of one of the buildings which surround a court with a pool in the centre. A number of outdoor exhibits have been placed in the court. Prominent among these is a lattice transmission line tower, but the most interesting equipment is an example of Brown Boveri's 220-kV air-blast circuit-breaking gear of which we shall have more to say later in these notes. Sprecher and Schuh, of Aarau, also have a display of 150-kV, 1,800-MVA equipment in combination with a Sécheron transformer. Other outside exhibits are two electric vehicles





Two views of the court of the Electrical Pavilion. That on the left shows the display of outdoor switchgear, etc., while the waterfall which attracts particular attention to the Pavilion is seen on the right

by Oehler & Co. (Zürich)—one a handsome runabout built in the form of the ordinary car and the other a tower wagon, with orthodox motor cab and bonnet, having the batteries conveniently slung at the sides. A mobile impulse generator for simulating lightning effects is also on view.

Probably the most interesting exhibit inside the pavilion is a large-scale model of a hydro-electric system reproducing exactly a section of mountainous country with its streams and lakes—natural and artificial. There are four stations illustrating both high- and low-head practice with model generating plant and water control.

The water-power section is naturally of the utmost interest to the Swiss, for over 90 per cent. of the nation's electricity is provided by hydro-stations, enabling a coal-less country to become one of the most electrified in the world. The walls of the hall containing the model bear numerous interesting diagrams and statistics relating to the harnessing and use of water power in all parts of the country.

An adjoining section is devoted to examples of hydro-electric equipment the largest of which is the rotor and Pelton wheels of a 37,500-kVA Oerlikon turbo-generator arranged so as to show the heavy windings of the machine. Examples of turbine runners, pipe-line sections and valves, as well as models of generators are also placed in this hall, the makers including Von Roll, Escher Wyss and Sulzer Bros.

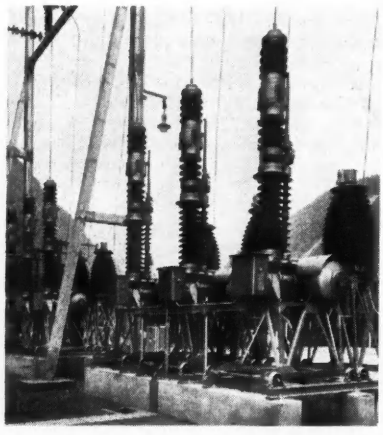
At the next section the visitor sees a remarkable collection of switch and control gear. An outstanding development which is exemplified is the air-blast circuit-breaker. Oerlikon have a 60-kV, 500-A, 800-MVA, three-phase set and Brown Boveri show a smaller model of the equipment previously mentioned—a 50-kV, 630-A, 600-MVA equipment as well as a metalclad switch cell with an 11-kV air-blast breaker.

Another unusual exhibit is a massive concrete section pillar (Union Kassenfabrik A.G.) with seven ways (three-phase) equipped with high-rupturing-capacity fuses. A 132-kV cable installation by Kabelwerke Brugg A.G. is also noteworthy.

In another section sub-station equipment is on view. The most important item is the exhibition terminal of the high-voltage DC system which has been carried out by the Brown Boveri Co. The power (500 kW) is brought from the Wettingen

station, where it is stepped up to 50 kV, by a single line with earth return. At the exhibition it is stepped down for distribution. The changes are made by means of mutators—which, as readers should know, is the more reasonable name for grid controlled rectifiers whose functions have increased considerably since they were first introduced. Other sub-station equipment includes transformers, ironclad and glass-bulb mutators, etc., by leading Swiss makers.

There are many excellent examples of instrument production, prominent among them being a Brown Boveri demonstration panel with high-speed distance relay equipment for 220-kV air-blast circuit breakers and another panel demonstrating the same company's quick-acting regulators.



Brown Boveri 150-kV air-blast switchgear installed at the Monte Piottino station of the Aare-Tessin system

A great deal of metering and relay apparatus is shown by Landis & Gyr. In addition to AC and DC equipment arranged in an easily understood manner the company demonstrates a single-wire system of central impulse control for a complete township, designed particularly for switching water heaters off at peak times. An interesting instrument is a power-factor indicator with dials showing kW, kVA and the wattless component. A meter-testing bench is equipped with a motor-generator set and the regulation of current and voltage is by means of transformers instead of resistances. Portable meter testing sets for use in consumers' premises are also included in the exhibit. In this part of the building Fr. Sauter exhibit a number of types of time switches.

Occupying a large enclosure is a two-million-volt, sixteen-stage impulse generator with which, periodically, "lightning" effects are produced. Opposite this is a model studio in which actual broadcast performances are given. The artists and the men at the controls are visible to the public through the glass soundproof walls of the studio and this proves as great an attraction as the "lightning" opposite.

In the Machinery Hall is to be seen a good display of machine tools, practically all designed for individual drive, most of them with built-in motors and control. Here, too, is a Brown-Boveri three-phase electrode furnace for steel production with a consumption of 2,450 kWh per 3,000 kg. (3-ton) charge and capable of producing 20 tons of steel in 24 hours. The same company also shows the electrical equipment for a low-frequency induction furnace for non-ferrous metals.

A further B.B. exhibit in this section is a 100-kW gas turbine set. It was intended to show a 6,000-HP set but at the time of our visit it had not arrived owing to delay in the delivery of a forging. We later saw it in the company's shops.

Nearby, Sulzer Bros. display a clever photographic panorama of part of their works (which we also visited) and a model demonstrating the operation of their single-tube boiler.

The Domestic Side

Passing into another section of the large building one comes to the utilisation section. On the way to the domestic apparatus there is a circular apartment devoted to lighting. Here there is a chronological display of electric lamps from the earliest patterns to the latest developments. Ingeniously designed cubicles demonstrate the benefits of good lighting and above them is the inscription "*Besseres Licht Bessere Arbeit!*" This, of course, has a familiar ring but the change from "sight" to "work" is characteristic of the Swiss. The cubicles are devoted to a reading lamp, a sewing machine, a lathe and writing, typing and school desks.

Some well-finished and handsomely designed cooking apparatus appears in the domestic appliance section. Cream seems to be the predominant colour, although blue-grey enamel is also largely used. Drop-down doors are, of course, employed by all makers. The ovens generally appear smaller for the external dimensions of the cookers than in British designs but the provision of three hot-plates on even the smaller sizes seems to be more common than in this country.

Water-heating equipment and the smaller domestic appliances are generally very similar to British products, although most of them possess that "Continental" touch which sometimes—certainly not always—is an improvement on what we are accustomed to.

There is a good collection of restaurant and hotel equipment, among which some special designs of grills by L. Beer (Zürich) drew our particular attention. One of these is a 10-kW equipment with top and side elements. At the rear of the cupboard is an element set in a polished reflector which directs the heat on to a revolving spit in the centre. In another model the turnspit is fitted vertically and there are central and side heating elements. The grill is mounted separately at the side and has top and bottom elements.

Examples of large roasting, baking and boiling equipment for institutions and hotels are shown by Kummler and Matter (Aarau), but apart from appearance they do not differ materially from the familiar British designs.

Transport Exhibits

By far the most striking exhibit in the Transport Section is the 12,000-HP electric locomotive (said to be the most powerful ever built) designed for the Swiss Federal Railways, and constructed by the Swiss Locomotive Works with electrical equipment by Maschinenfabrik Oerlikon. This is to operate on the standard 15,000-V, 16⅔-cycle system on the St. Gothard line. It has 16 motors geared to eight driving axles, and is capable of a maximum speed of 110 km. (66 miles) per hour. It is intended to haul 770-ton trains up the steep grade of the St. Gothard line at 75 km. (45 miles) per hour, and will return energy to the line on the down grades. The locomotive weighs 234 tons and has an overall length of about 110 ft. It has a driver's cab with control equipment at each end.

The Sulzer concern has contributed a Diesel-electric locomotive to the display. The eight-cylinder engine of this locomotive works on the four-stroke cycle with direct injection; the one-hour rating is 1,200 BHP at 750 RPM, and the continuous output 1,050 BHP at 660 RPM. A notable feature of the construction is the building up by welding of the crankcase and cylinder block. A welded auxiliary frame carrying the Diesel engine and the generator set is connected to the crankcase by welding to form one single piece. All moving parts are totally enclosed and automatically lubricated. The speed is automatically maintained by an electro-pneumatic control. The electrical equipment, supplied by Brown Boveri, includes a supercharging set, the electric generator and motors for driving, cooling water circulation and cooler fan, the last-named being driven by a motor directly connected to an auxiliary generator.

Other exhibits in this section are a trolley-bus for the Winterthur system and a tramcar for the Zürich street railway.

This is a suitable point at which to mention the Exhibition transport arrangements. On both shores there is a service of open battery-driven cars seating about twenty passengers which make a tour of the principal ways. A novelty is the *Schifflibach* ("little boat brook"), a narrow canal which traverses the exhibition grounds on the Enge side bearing small boats along by means of a current produced by an ingenious pumping arrangement.

A 10-kW grill equipped with a turnspit and special elements

Between the two shores is a *Schwebebahn* (suspended railway) upon which two cars carrying about twenty people at a time operate. The towers on each side are 225 ft. high and the span of the cables is 2,700 ft. We were told that the equipment has been sold to Sweden for the Oslo exhibition which is now being planned.

We have been able to deal only with the principal engineering features of the Exhibition, but in every section there is something of electrical interest, as there must naturally be nowadays. A visit to the Exhibition can be recommended to everybody who is going to Switzerland during the next few months.

At Brown Boveri's

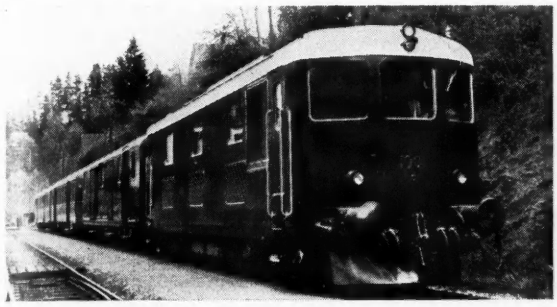
While we were in Zürich Messrs. Brown Boveri kindly arranged an inspection of their Baden works, where upon arrival we were greeted by Mr. C. M. Morier, who, in spite

of many years' residence in Switzerland, has retained his pleasant Scottish accent. He enlisted guides to show us some of the principal activities of the company, which are many and varied. The works employs about 6,000 people and everybody starts at 7.30 a.m.—even the senior members of the staff. We do not propose to describe the works, as our tour was a fairly rapid one. Mention can only be made of the more interesting work which we saw in progress.

Passing through the main erecting shop, claimed to be the largest in the country, we were shown a high-frequency furnace under test, and exercised our musical ear by noting the change of pitch as the frequency was raised and lowered. Next we went into the "mutator" department, where we saw grid-controlled units in various stages of construction. A notable feature, and one common to other productions of the works, is the use of welding for the building up of parts.

A development of which the company is proud is its thermal relays. We saw many examples of these being made and tested. It is claimed for this type of relay that as the main current flows continuously through it and is thus subject to the same heating effect, it becomes a "thermal image" of the machine protected and acts like a contact thermometer.

The time constant of the relay is adjusted in three steps of 15, 30 and 45 minutes by attaching "heat carriers" of various capacities. By virtue of compensation arrangements the relay acts independently of the ambient temperature, and



The 1,200-h.p. Sulzer Diesel-electric locomotive on a trial run

instantaneous limit-current tripping is provided. The calibration of the "heat carriers" is a critical task which has to be individually performed for each unit.

One of the chief developments of the company in recent years has been the production of air-blast circuit-breakers for high voltages. We saw some of this equipment under construction and being tested. Mention has already been made of the 220-kV example at the Exhibition, and herewith we illustrate an installation of 150-kV air-blast switchgear at the Monte Piottini power station of the Aare-Tessin system in Olten, Switzerland.

The breakers are provided with extinction and disconnecting contacts. When the main pneumatic valve opens compressed air flows through hollow insulators into an extinguishing chamber, and under the influence of the great pneumatic force exerted the extinguishing contacts move apart at high speed. The disconnecting contacts, which are in series with the others, open after the latter with a certain time lag and under no current. The total rupturing time is said to be between 0.04 and 0.05 sec.

The Gas Turbine

As we have said, we saw in the shops the 6,000-HP gas turbine which the company intends to show at the Exhibition. This subject was dealt with fully in a paper read before the Institution of Mechanical Engineers in February by Dr. A. Meyer, a director of the Brown Boveri Co. One of the principal attributes of the gas turbine is that it is self-contained. As its net efficiency is only about 18 per cent. it cannot compete with modern base-load steam turbo-generators, but it has application in traction, marine propulsion and in combination with steam plant—particularly where steam is used for process work, when a combustion turbine with an exhaust gas boiler would be more economical and cheaper than a high-pressure steam plant with back-pressure or extraction turbines.

Further progress may be anticipated from the fact that a 1 per cent. increase in the efficiency of the compressor or the turbine means an improvement of 4 per cent. in the cycle efficiency. This progress is dependent upon the provision of means of realising an operation temperature of 1,200 deg. F.

In the afternoon we proceeded to the Gösgen hydro-electric station with Herr Wild to inspect an installation of the company's 150-kV air-blast switchgear. This station, although not a new one, is an excellent example of Swiss hydro-electric practice. The high, light, and airy machine hall contains seven 7,000-kVA vertical generating sets deriving their power from the Aar. It is a part of the extensive Aare-Tessin system, and as well as providing power acts as a switching centre dealing with very large blocks of power. It is truly international, for it acts as a "power exchange" for Switzerland, Italy, Germany and France.

The Sulzer Works

On the following day we went out to the Sulzer Works at Winterthur, where we were met by Herr Robert Sulzer, who, with Herr Max Trechsel, acted as our guides.

As in the case of the Brown Boveri works, we were struck by the amount of welded construction now being employed for heavy machinery parts. We saw some excellent work of this kind in a number of boiler drums, but most noteworthy, perhaps, was the welding of large stainless steel vessels used in the condensed-milk industry, which is done by a special process for which the company has rights.

Probably the largest job in progress at the works was the building of two 9,000-HP Diesel generating sets for Bucarest. One of these was undergoing tests at the time of our visit. There were also a number of smaller stationary and marine engines in various stages of construction. A feature of the main erecting shop is the system of handling large parts. A 75-ton travelling crane spans the shop, and below it are two smaller ones for dealing with the comparatively lighter parts.

There was a great deal of work going on in the pump and compressor works, and we were shown a number of interesting developments in central heating equipment. In the smaller-Diesel department the building of the company's new two-stroke opposed piston engines was witnessed. This engine, which is built in sizes up to 120 BHP, is of very neat and compact design. Two opposed pistons work in each of the horizontal cylinders. The compression space is in the centre of the cylinder between the pistons, so that no cylinder covers are required. As the effective working stroke is divided between the pistons the speed of each piston is unusually low, resulting in increased durability and low maintenance costs. Special attention is paid to the balancing of the heavy masses. The scavenging and fuel-injection systems ensure perfect combustion and low fuel consumption.

Upon completing our tour of the works we were taken to the apprentices' hostel, a typical large Swiss farmhouse, where the arrangements are most complete and comfortable. The company has an excellent apprentice-training system, operated in conjunction with the State, a feature of which is the placing of students as soon as possible on practical production work.

We have to conclude these notes with an appreciation of the courtesy and hospitality of our hosts throughout our visit. The principal impression gained from all that we saw was one of a hard-working people carrying on with the maximum of efficiency and the minimum of fuss.

Developments in Manchukuo

A CORRESPONDENT states that no part of the Far East is more active in the development of electrical power than Manchukuo. Under the supervision of Japanese electrical engineers and capitalists this work is being rushed forward so as to provide the State and industrial and private interests with adequate facilities for the use of cheap and abundant light, heat and power. In this connection extensive constructive work is being carried on for the establishment of a new harbour not far from Antung, to serve the mercantile interests of the city. An idea of the magnitude of the undertaking may be gathered from the eight years allowed for its completion and the inception of commercial operations, and from the cost, between £7,000,000 and £8,000,000. To supply sufficient electric power for years to come seven plants along the upper stream of the Yalu River have been planned. When completed they will total 2,000,000 kW in capacity. One of the stations being built about 80 kilometres up the river will be named the Suiho power station and is expected to have an output of 700,000 kW. Although it is not proposed to open the station until towards the end of 1941 it will be in a position to generate about 200,000 kW by the end of next year. Another power station along one of the tributaries of the Yalu River is to have an output of 500,000 kW. The coal mined at districts along the upper stream of this river may also be utilised for the generation of electricity through the construction of a steam power plant. Engineers from Japan are in charge of a number of Manchukuoan electrical improvements and developments. Although the Sino-Japanese war is inevitably absorbing a large part of Japanese finances, there appears to be, so far, no scarcity of capital for the installation of power plants and for the establishment of electrical companies in different parts of Manchukuo. Similar enterprises in North China are contemplated by the use of capital and engineering skill to be provided by Japanese interests.

Organisations of the Industry—XIII

The Electrical Trades Union

By J. Rowan, J.P., General Secretary

THE year 1889 is famous in trade union history for the great Dock Strike and for the impetus given by it to what was called the "new unionism," a movement headed by leaders still living, foremost among them being Mr. Ben Tillett, Mr. Tom Mann and the Rt. Hon. John Burns. The object of this movement was the organisation of unskilled workers in trade unions, and several unions were formed which admitted many types of workers.

The Electrical Trades Union began in 1889 in London as the Amalgamated Union of Electrical Operatives and practically simultaneously in Manchester as the Amalgamated Union of Telegraph and Telephone Construction Men. The members of both unions were concerned mainly with outside line erection. Negotiations between the unions were followed by amalgamation and the adoption of the proposal by the Manchester group that the title be changed to the "Electrical Trades Union of Gt. Britain and Ireland." For seventeen years the head office was retained in London, but in 1907, when I was appointed general secretary, it was removed to Manchester.

[*Jerome*
Mr. E. W. Bussey, President of the E.T.U.

This change was imposed by the greater development of the electrical industry in the north, but when all industry and all householders became "electricity conscious" the wisdom of a return to London was apparent. And so in 1930 the E.T.U. bought a Victorian house in Macaulay Road, Clapham Common, and converted it into offices. Owing to the growth of the membership the union was compelled this year to acquire an adjoining house to which a new board room has been built on. This, by the way, is equipped with one of the largest laylights in the country. In these two houses (with their gardens) the officials and the staff of fifteen work in conditions many will envy.

The Electrical Trades Union was interested at first in the wages and conditions of men engaged in telegraph construction, telephone installations and maintenance. At that time telephone systems were conducted by private companies or municipalities. A dispute with one of the private companies, the Brighton Telephone Company, nearly wrecked the fortunes of the Union. A strike ensued which almost emptied its coffers. The private companies were later merged into the National Telephone Company, and in 1912 the telephones were taken over by the Post Office (with one or two exceptions).

The latter development involved another loss for the E.T.U. as the telephone employees of the Post Office formed a separate union to look after their interests. These setbacks, plus internal dissensions, and the ever-present difficulty of persuading the workers in the industry to join an organisation for the advancement and protection of their interests, acted as a powerful brake on the progress of the union. In 1891 the membership was over 1,100. Nearly twenty years later it was still under 2,000.

Skilled Employees' Conditions

The influence of the union was not, however, to be measured by its numbers. That was sufficiently great to enable it to secure recognition and status for electricians and armature winders, and to obtain for them wages and conditions comparable with those of other craftsmen. What was known as the Winding and Instrument Shop was organised from the beginning but is now in separate sections and the union has for many years had agreements with the Engineering and Allied Employers' Federation. With the development of dynamos, new types of skilled employees were evolved, and the progress of the E.T.U. has been contemporary with this evolution.

After 1910 the membership increased steadily, and by 1913 had risen to over 7,200. Nevertheless, the wages and conditions of many workers in the industry were deplorable. This indictment may be illustrated from the state of things prevailing in the power stations during the war. In many cases men in charge of switchboards in generating stations were paid no more than ten to fifteen shillings a week, with a boy assistant or an unskilled man at low wages. The shift engineers were often ex-students willing to accept these terms for the experience gained. Hours at that period were 56 per week, overtime payment was a rarity, and during illness few received any allowance. Rising prices made these conditions unbearable, and the technicians flocked into the Electrical Trades Union as did other grades. In 1920, "dilution" assisting, the membership had risen to over 57,000.

The E.T.U. in 1917 set up a committee of workers engaged in the principal power stations of London, their task being to disentangle the chaos of grades and their diverse remuneration, and to propose a reasonable scale of wages, overtime payment, and regulations for the admission of apprentices. The committee produced a scheme which was embodied in what was known as the "Green" trade card, which, however, did not meet with the approval of the employers. In the end the dispute was referred to the Committee on Production, which in November, 1918, issued the now famous "Award 2772," by which the Union's chief claims were granted. The award applied to London only, but eventually it became the basis of agreements which covered the whole of Great Britain, thus co-ordinating under one scheme the bewildering variety of conditions previously existing.

Joint Councils

Pending the establishment of a Whitley Council for the supply industry after the war, a negotiation committee was set up, and the E.T.U. put forward a demand for the reduction of hours from 56 to 47 per week for day workers and 48 for shift workers. The employers were at first adamant against making this concession and a strike was imminent, but at the last moment they agreed to the reduction.

In May of the same year (1919) the National Joint Industrial Council for the Electricity Supply Industry was formed, in the initiation of which the E.T.U. had played an active part. This Council is composed of 52 members, 26 representing employers, private and municipal, and 26 representing the unions with members engaged in the industry. The chairman and vice-chairman are chosen alternately from each side, and from the beginning I have acted in one or the other capacity.

The functions of the Council are broadly to secure joint action between employers and employees in all matters affecting the safeguarding and improvement of the industry. The consideration of wages, hours and working conditions is one of the chief tasks of the Council, but negotiations on these matters are conducted first by each of the fourteen district councils. Should differences arise, they are referred to the National Joint Council, and if agreement is not reached there, may, by agreement, be considered by the Industrial Court.

The Contracting Industry

The Electrical Trades Union also combined with the National Federated Electrical Association and the Electrical Contractors' Association of Scotland in the formation of the National Joint Industrial Council for the Electrical Contracting Industry, of which I have been co-secretary from the start, while the chairmanship alternates between a member of the E.T.U. and a member of the employers' associations.

This branch of the industry has been through many stormy times. Through the whole period, however, the E.T.U. has been the only union to have effective control of the labour employed in the installation of electrical apparatus and wiring of all kinds. This close relationship has been mutually beneficial in the evolution of the industry. In passing, it may be mentioned that quite a number of E.T.U. members have changed over from manufacture and installation to maintenance, and in practically every section of industry where a substantial amount of electrical apparatus is installed, as in the newspaper press, the iron and steel trades, and similar industries, the E.T.U. is the nationally recognised authority for making agreements on behalf of the electrical workers engaged in this work.

In shipbuilding the E.T.U. has from the beginning of the electrification of ships been the recognised authority for negotiating wages and labour questions in all branches of the electrical industry affected, and, along with other engineering unions, is represented on the Government Shipbuilding Trade Joint Council, which deals with wages and conditions in

Government establishments. The secretary of the workers' side of this Council is Mr. Matthew T. Greenwell, one of the Union's two assistant general secretaries. It is represented also on the Government Engineering Trade Joint Council, the War Office Industrial Council, the Office of Works Council, the Air Ministry Council, the Admiralty Industrial Council, and the Co-ordinating Committee for Government Trade Joint Councils. Mr. Greenwell is also secretary of the workers' side of this Co-ordinating Committee.

Further, the E.T.U. is a member of the National Joint Industrial Council for the Cable Making Industry, in the formation of which it took part in 1919, and in the post-war period has established close relations with the Electricity Commissioners and the Central Electricity Board, in order to further the continuance, under the more centralised conditions, of the relationships set up between the union and the various employers' associations.

Since the formation of these councils, rises or falls of wages have been mainly effected by agreement, the basic rates (subject to changes) being generally governed by a sliding scale arrangement according to the cost of living index. Sometimes there are awards by arbitration. The average wages per week last year (1938) including all sections, were 70s. 8d. In 1914 the comparable figure was 29s. Hours remain as fixed in January, 1919, *viz.*, 48 for shift workers and 47 for day workers in all sections of the electrical industry.

Record Membership

The swollen membership of the E.T.U. in the war years was soon reduced, the slump of 1921 dotting the i's and crossing the t's of the return to "normalcy." By 1930 the numbers were down to 31,450, nearly 16,000 fewer than in 1920. Then the "economic blizzard" arrived, but the union weathered this with surprising buoyancy, and by 1936 had added nearly 17,000 to its membership, the number being 48,400. In 1937, the figure was increased by nearly 10,000 to over 58,000, and last year the number rose to 63,000.

The finances of the union have had similar up and downs. After the General Strike of 1926 the E.T.U. was actually in debt. To-day the assets are valued at £139,000. The income in 1937 was £110,000, the expenditure £66,000. During the last 48 years the E.T.U. has paid to its members in benefits (unemployment, travelling, accident, funeral, dispute and benevolent) the sum of £638,500. This is a record of which the members are naturally proud.

An approved society under the National Health Insurance Acts was established in 1912. The membership in 1937 was just over 4,000, a comparatively small number, but by efficient management the Society has built up surpluses enabling it to increase sickness and disablement benefits by 33 per cent. and maternity benefit by 25 per cent., while dental and ophthalmic treatment and appliances are free. The total benefits disbursed up to 1937 amounted to £73,000, plus additional benefits, £13,250.

Organisation and Administration

The government of the Electrical Trades Union is vested in an elected Executive Council, which consists of eleven members working at their trades, the general president, the general secretary, and two assistant secretaries. The Executive Committee meets bi-monthly. All full-time national officials are elected by ballot vote of the whole membership, and area officials are elected by ballot of the area membership. Full time officials hold office for five years, and are eligible for re-election. A biennial policy conference is composed of elected delegates chosen by the members, who for this purpose are allocated to 42 geographical areas. A rules revision conference is held every six years. In addition to the head office, the E.T.U. has fifteen area offices, each in charge of one official, with a clerical assistant, London excepted, which has four officials and assistants.

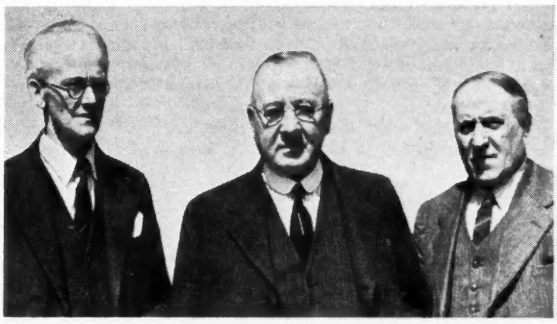
The writer has occupied the position of general secretary for 31 years, having been re-elected ten times. He joined the union in 1897, and in the following year was elected secretary of the Manchester and Salford branch. In 1904 he became the union's full time organiser, a position he held until his appointment as general secretary in 1907. He is responsible also for the conduct of the union's monthly organ, the *Electrical Trades Journal*. This was started in 1905 under the title *Eltradion*, and has proved its value to the membership as a source of information on trade union affairs and the electrical industry generally.

Headquarters Personnel

The Union's two assistant general secretaries, by their length of service, corroborate the fact that members of the union are well satisfied with their leading officials. Mr. Robert Prain has now occupied his present position for twenty-five years. Previously he was a member of the Clyde District Committee. From 1919 to 1924 Mr. Prain's colleague was Mr. W. M. Citrine, now Sir Walter Citrine, and general secretary of the Trades Union Congress.

Mr. Matthew T. Greenwell succeeded Mr. Citrine as assistant general secretary in 1924, and has thus served for fourteen years. For the same period he has been a member of the London Advisory Committee on Juvenile Employment (Ministry of Labour). As already mentioned he is workers' side secretary on two Government Councils.

The general president of the E.T.U. is Mr. E. W. Bussey, who has occupied that position for six years. He joined the



[Elec. Rev. photo.

Mr. J. Rowan, the General Secretary (centre), with Messrs. M. T. Greenwell (left) and R. Prain (right), Assistant General Secretaries

Union in 1917. The honorary life vice-president is Mr. J. W. Ball, who was general president for twenty-four years. Mr. Ball joined the Union in 1899, and co-operated with the writer in establishing it on a firm foundation.

The motto of the Electrical Trades Union is "Light and Liberty." It claims modestly that during its existence it has pursued the ideals implied in the phrase, and that through its activities it has played a useful and honourable part in the development of the electrical industry.

A.S.E.E. Annual Meeting

MR. J. J. SMITH, vice-chairman, presided at the annual meeting of the Association of Supervising Electrical Engineers held on May 2nd at the National Hotel, London, W.C.1, and, in presenting the Executive Council's report for the past twelve months, said that it showed not only a further increase in the educational and social activities but that matters of national importance, and other vital questions of policy, had received close attention. The continued growth of the Association, both in numbers and in power, was a matter of satisfaction, but they could not remain content while any eligible engineers were outside their ranks. An important item in the proceedings was a resolution, carried unanimously, protesting against the action of the Banbury Co-operative Industrial Society, Ltd., in dismissing its electrical engineer for joining his appropriate trade union. The full support of the A.S.E.E. was pledged to safeguard the interests of the member concerned and the principles involved. Another unanimous resolution was one calling upon the Executive Council to investigate anomalies at present existing in the electricity supply industry due to supply authorities adapting salary grades of the National Joint Board schedule to fit graded appointments.

At the meeting Messrs. R. F. Appleyard, L. W. Medcalf, W. R. Durtnall, T. Whetton, and J. D. Reddy were elected to the Executive Council, a sixth vacancy having been filled by the election by local members of Mr. J. Thompson as representative for the Regional Area of Yorkshire. Votes of thanks were accorded the retiring members, Messrs. H. A. Crabtree, C. F. Fawdry, G. Jelley and F. G. Quance, and to honorary members serving on special committees.

Scientific Computation

THE last of this season's monthly luncheons of the Batti-Wallahs' Society (to be resumed in September) was held, as usual, at the Hotel Victoria, with Mr. J. McCaffery (president) in the chair. The principal guest was Dr. L. J. Comrie, who for ten years was in charge of the production of the Nautical Almanac at the Admiralty, but now conducts independent scientific computation.

His address dealt with achievements in this connection and some of the machines used for this purpose, of the card-perforating and modified accountancy types. Specimens of electrically and hand-operated patterns of American, German, and British makes were on view. As an example of their capabilities Dr. Comrie mentioned the calculation of steam temperature tables, and also how the motion of the moon had been worked out up to the year 2,000 in seven months by machines at the rate of twenty figures per second. Past-president L. M. Waterhouse proposed a vote of thanks to the speaker.

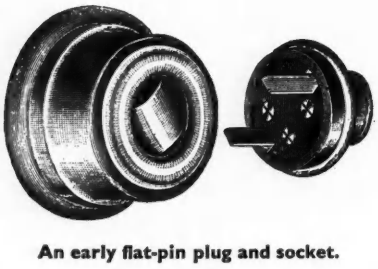
CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publieation. The Editors cannot accept responsibility for correspondents' opinions

Plugs and Sockets

I was interested to read the article on this subject from a correspondent in your issue of May 19th. About the year 1894 I patented what at that time was the first flat-pin plug. This had a certain amount of success but its success did not survive for long, the preference at that time being overwhelmingly in favour of the round pin and concentric types. I enclose one of my old price lists and you will see a description and illustration of this on page 34.

Like so many other accessories which are now in use and which are presumed to be new ideas, they are only old ones resuscitated. I was able to see one of these plugs which had been in use since about the time I mention above and is still being used.



An early flat-pin plug and socket.

EDWARD L. JOSEPH.

May 22nd, 1939.

[The descriptive matter accompanying the picture says:—"This wall socket will supply a long-felt want for a cheap and reliable wall plug. That part which is secured to the wall has a china cover, which *screws* on, and is provided with a cut-out. It is impossible to short circuit it by placing anything across the contacts, as these are hidden from view. It also presents a very neat appearance when the top is not on, that is, when not in use. The portable part has many new points in its construction. The small part of china, to which the contacts are secured, screws into the top, thus keeping the whole clean and neat in appearance."—EDS. ELEC. REV.]

Age Limits

In your issue of May 5th, two correspondents have made timely reference to the growing tendency—not to say evil—of setting age limits for many appointments in the electrical industry. "Raw Deal" rightly directs attention to the call of the Government to men of 45 to 51 for National Service, yet a recent advertisement for a post carrying a salary of £1,000 per annum, and another for a less lucrative post for a control engineer, set the age limit of prospective applicants at 40 years.

The operation of superannuation schemes is usually adduced as the primary cause of this practice, but it is interesting to recall that it was hoped that the unification of superannuation schemes by the Act of 1922 would remedy the evil then prevalent, *viz.*, the injustice of holders of certain appointments not being able to change them without possible forfeiture of benefits. On the contrary, the beneficent superannuation scheme is now, in effect, being made an excuse for the pernicious practice of intensifying the injustice and, indeed, of making it impossible for persons above a certain age to change their appointments at all.

The industry might well have taken note of the slogan of the present Minister of Labour a little while ago of "Not too old at fifty."

May 22nd, 1939. FIT AND FORTY.

The Institution's Policy

The questions raised in the article in your issue of April 26th are of the first importance, both to members of the Institution and to the great electrical industry with which they are associated.

While there are, of course, the usual opportunities for advancement available to those whose training has been confined to engineering technology, technical men frequently complain that comparatively few of such opportunities on the administrative side are open to them for want of preparation on their part in that direction. It is not to be expected that engineering institutions will extend their curricula further in this direction than to include an omnibus management subject, or at most two such subjects.

Members of such institutions, however, who wish to cultivate such administrative ability as they may possess need not look to their institutions for thorough training in management, but can take advantage of excellent facilities which are now available in several large centres, *e.g.*, London and Manchester.

It may appear to be a counsel of perfection that a young man who has completed a technological education should take up a further course of study in management; but it frequently happens that the ordinary duties of his early appointments are not so onerous as to preclude such study, which is desirable and indeed necessary (1) to make his ordinary departmental work more interesting to himself and more effective to his employers, and (2) to prepare him to discharge important administrative duties with credit to himself and benefit to his employers when opportunity offers.

Uninstructed ability is at as much disadvantage in this field as in any other where professional skill is needed. The "light of nature" and such experience as one individual may pick up for himself are no longer considered adequate preparation for the exacting profession of management, involving the effective co-ordination and integration of functional experts.

A valuable body of knowledge of the technique of management is now available, and it is as necessary for the would-be successful practitioner of management to avail himself of it, as it is for an aspirant to any other profession to do the like.

H. MCFARLAND DAVIS,
Registrar and Secretary,
Institute of Industrial Administration.

London, S.W.1, *May 16th*.

Pumping Methods

My attention has been drawn to a statement which seems to me to be ambiguous in the article in your issue of May 19th by Mr. F. Johnstone Taylor entitled "Pumping Methods: A Survey of Modern Electrical Practice."

In the concluding paragraph Mr. Taylor says "While waterworks with units of 1,000 HP are becoming quite common in the United States, the largest built for Britain or the Dominions up to the present hardly exceeds 700 HP." Presumably the author has in mind electrically driven plant, but in view of the fact that elsewhere in the article he also refers to certain gas-engine driven plants, the words in question might be taken to have a general application to all types of pumps.

He mentions particularly "Britain or the Dominions" and taking representative cases at random might I point out that as far as this country is concerned this firm is just installing four turbine-driven units of over 1,000-HP each and four of 3,700-HP each in a well-known pumping station, and taking the Dominions, we have supplied a large number of units of well over 1,000 HP to the Union of South Africa and have in hand a further set of about 7,000 HP.

In the *Engineer* of the preceding week, May 12th, there was a short article on American centrifugal pump design, in which it was stated that while the tendency has been towards electric driving on account of simplicity, as Mr. Taylor says, nevertheless turbine-driven pumps are now on the increase on account of flexibility as regards small ranges of speed.

Bedford, W. H. ALLEN, SONS & CO., LTD.,
May 20th. G. A. NIELD.

Physics in Industry

THE growing importance of physical science in almost every branch of modern industry is reflected in a 15 per cent. increase in the membership of the Institute of Physics (president: Dr. C. C. Paterson, G.E.C. Research Dept.). Its annual report shows that at the end of 1938 the membership stood at 1,169, as compared with 753 as recently as 1934. A particularly successful undertaking has been the holding of summer schools at university centres to assist members in keeping up to date with recent discoveries in pure and applied physics.

Discussions were held during the year by the Institute's branches on such varied subjects as cosmic rays, the strength of materials, the science of illumination, the development of sound-locators for anti-aircraft defence, and many electrical or allied subjects.

NEW ELECTRICAL PRODUCTS

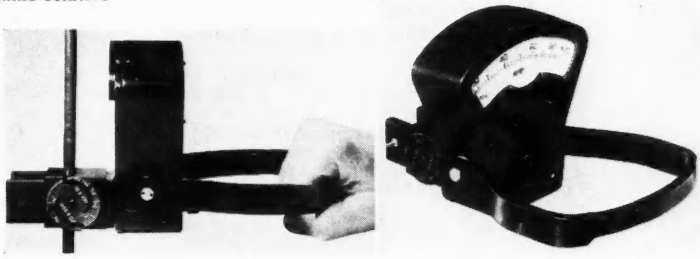
A Review of Equipment Recently Marketed

Slip-on Ammeter

AN ammeter for measuring AC and DC without breaking the circuit has been designed by SALFORD ELECTRICAL INSTRUMENTS, LTD., Silk Street, Salford.

It comprises a special type of moving-iron movement mounted between the poles of a high reluctance open iron circuit in a moulded case, with an insulated carrying handle. The poles are formed by the inner ends of two limbs which project from the back of the instrument, and which in use are placed astride the conductor in which the current is to be measured.

The accuracy of the instrument depends on the position of the centre of the conductor being always in the same relative position for a given range with regard to the instrument, and this is ensured by means of a stop which slides over the projecting limbs, and is located by means of a calibrated adjustable cam set according to the outside diameter of the conductor. The stop has two adjustable positions, giving ranges of 0/100 and 0/200 A, respectively.



Two views of the slip-on ammeter

The full scale accuracy is 1½ per cent. on AC and 3 per cent. on DC, the open iron circuit and the low flux density result in very small hysteresis errors, while the absence of any external movable parts in the iron circuit renders the accuracy permanent, and at the same time enables measurements to be made on cables closer together than is usual. On DC the accuracy may be made even greater, if, after taking a measurement, the instrument is demagnetised by reversing it during the slow withdrawal from the conductor.

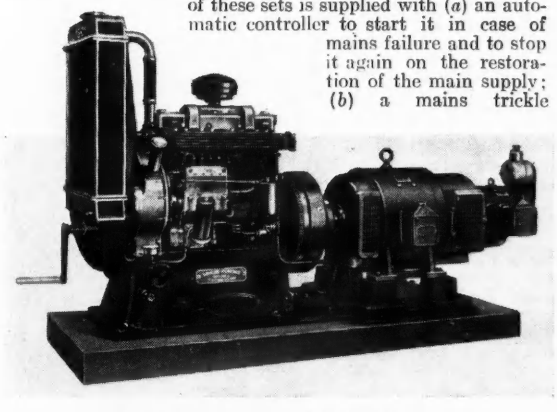
The instrument may be used on circuits of any voltage, and in the case of bare conductors the only limit is imposed by the flash-over distance from the conductor to the hand holding the instrument, usually about 6 in. To use the instrument for measurements on high-voltage lines, where so close an approach would be dangerous, an extension handle can be supplied.

It is claimed that this ammeter cannot be damaged by accidental overloads.

Emergency Lighting Plant

The necessity for providing stand-by equipment for lighting, &c., as an air-raid precaution lends particular interest to the introduction by the KOHLER CO., LTD., 216, Great Portland Street, London, W.1, of additions to its range of automatic plant. The smallest of these new models, a ¾-kW petrol driven unit, is eminently suitable for the smaller type of property, while at the other end of the range are 15- and 40-kW Diesel plants such as have been installed respectively at the new London County Hall extensions and the Westminster Hospital.

With these new models the company now has available a complete range of equipments from ¾ to 50 kW capacity in petrol, town gas or Diesel types. Each of these sets is supplied with (*a*) an automatic controller to start it in case of mains failure and to stop it again on the restoration of the main supply; (*b*) a mains trickle charger for the starting battery, and (*c*) in the use of AC plants, automatic voltage regulation. If special emergency circuits are not used, transfer switchgear can be supplied so as, on a failure occurring, to disconnect automatically normal circuits from the mains and transfer them to the plant and *vice versa*.



Kohler emergency lighting plant

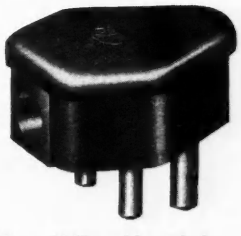
One special plant we were recently shown at the company's showrooms was a 10-kW unit, which in addition to coming into operation automatically when the mains fail, provides for 1,200-W lamps to work off the starting battery at 50 V. These 50-V "intermediate" lamps form part of the general lighting scheme and are normally fed through a 230/50-V transformer from the AC mains. When a failure occurs they are automatically switched over to the 50-V starting battery of the 10-kW plant, and remain illuminated until just after the emergency plant has taken up its load. There is thus no period of darkness at all. This particular unit has been ordered for a Marks & Spencer's new building at Birmingham and is designed to work off the town gas with provision for changing over rapidly to petrol should gas be cut off in a crisis. A similar set is also being supplied for the same company's new store at Blackpool.

The petrol and town gas plants are, of course, much more compact than the Diesel units and are particularly suitable for the smaller type of buildings where the use would be only intermittent. In cases, however, where the plant is likely to be required fairly continuously and where over 10 kW is required, the Diesel types are recommended, since they are very much cheaper to run and their size does not increase proportionately with the higher capacities, a 20-kW plant being, for example, only very slightly larger than a 10-kW unit.

Rubber-clad Plugs

Unbreakable rubber-clad plugs which comply with B.S.S.546 are the latest product of M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, London, N.18.

These new plugs comply without reservation with B.S.S. 546 and an important point of this specification is that it must not be possible for "overhang" to occur. The pins are mounted on a rigid non-track base so as to prevent overhang by distortion when used in a surface socket.



New M.K. rubber-clad unbreakable plug

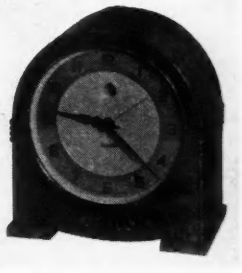
The cover is robust and conforms with the general design of the company's standard bakelite plug. Wiring is simple with an effective cord grip, so that the new plugs should meet a long-felt want in industrial establishments where the bakelite pattern is likely to get broken. The plugs are available in both 5- and 15-A sizes.

Self-resetting Alarm Clocks

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is now marketing an alarm clock with an automatic resetting device, the alarm being reset for the same time the following day.

The clock has a 24-hour alarm and is low in price. It has a moulded bakelite case finished walnut or ivory and is fitted with a silvered circular dial measuring 3¾ in. in diameter. The size of the clock, which has a rounded top, is 4¾ in. high by 4¾ in. wide by 2¾ in. deep and the weight is 1 lb. 5 oz.

Another new model is a low-priced mantelshelf clock. This, too, is in a bakelite case finished walnut or ivory but with a chromium or gilt bezel and raised zone. This model is rectangular in shape and measures 6 in. high by 7½ in. wide by 2½ in. deep and the weight is 1 lb. 3 oz.

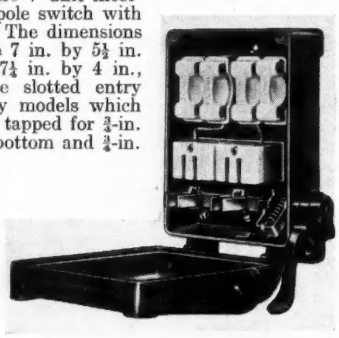


"Genalex" automatically reset alarm clock

Combined Splitter and Switch-Fuse

A recent product of the REVO ELECTRIC CO., LTD., Tipton, Staffs, is a splitter which is combined with a switch-fuse.

It is an inexpensive 250-V unit incorporating a 30-A double-pole switch with four or six 15-A fuses. The dimensions of these two models are 7 in. by 5½ in. by 4 in. and 7 in. by 7¼ in. by 4 in., respectively. There are slotted entry types and conduit entry models which are supplied drilled and tapped for ¾-in. or 1-in. conduit at the bottom and ¾-in. conduit at the top.



Revo splitter and switch-fuse

A Flexible Coupling

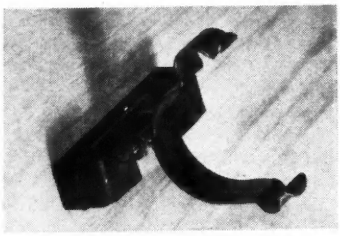
The "Torflex" coupling, which is being supplied by HOWARD GRAHAM, LTD., Tiddington Road, Stratford-on-Avon, is designed through the use of rubber, to enable a high efficiency drive between driving and driven shaft to be obtained even when they are considerably out of alignment.

The couplings are suitable for drives of up to 1¼ in. diameter shafts. Two-point flexibility allows maximum angular and parallel misalignment of the shafts and the torsional flexibility cushions the drive. The steel caps are threaded according to the direction of drive to be self tightening.

The outside diameters of the coupling are 1⅛ in., ⅝ in. and ⅝ in., with maximum torques of up to 90-in.-lb. A new model will take torques of up to 480-in.-lb.

Anti-vibration Mountings for Tubular Lamps

LINOLITE, LTD., 100, Victoria Street, London, S.W.1, announces the introduction of a special anti-vibration mounting for incorporation with the standard hinged fixing clips for reflectors with double capped tubular lamps. The device should be particularly useful for ship lighting and automatic machines.



The "Linolite" anti-vibration holder

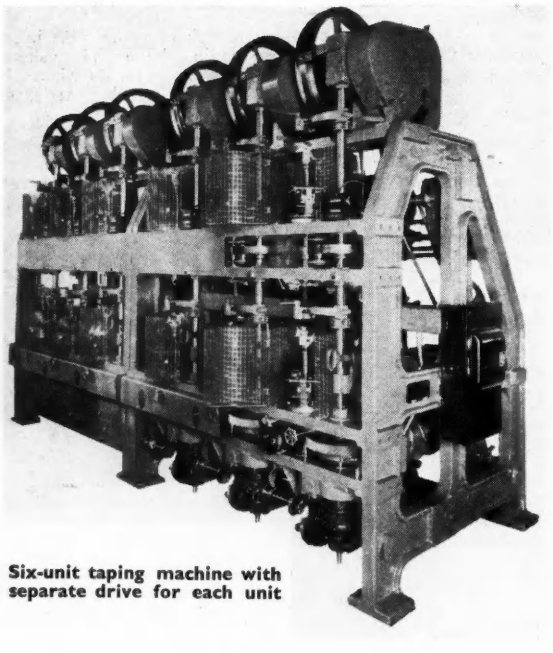
Insulating Machines

A six-head paper-taping machine developed by the American Insulating Machinery Co. is being introduced to the British market by JAMES DAY (MACHINERY), LTD., Sentinel House, 46, Southampton Row, W.C.1. Each unit is driven by a self-contained variable-speed 2-HP motor with hand-wheel adjustment of flyer speed up to 1,000 RPM. Two tapes in the same direction are applied by each flyer from eccentrically mounted discs 9 in. in maximum diameter and up to 1 in. in width.

Tensioning is constant for the entire disc. A unit is stopped by an automatic knock-out in the event of a tape breaking or a disc becoming empty or by a capstan-operated counter when a predetermined length of wire is insulated. Finished wire spooling is individual to each unit; a traverse on each unit, instantaneously reversing at corners, is adjustable during running for width of wheel and for rate of traverse per turn of reel. Individually driven wire-cleaning brushes are fitted.

The machine has a capacity for flats up to 0.4375 by 0.078 in. and for squares up to 0.185 in. Its dimensions are 14 ft. 7 in. by 6 ft. by 9 ft. 6 in. high, and its net weight 20,000 lb.

Another introduction is a horizontal three-head machine for covering copper strips either with three cotton wraps or with one layer of paper and two of cotton; in the latter case a Reeves variable-speed device provides for variations in RPM of the cotton head. The finished wire-reel stand is driven by a separate motor.



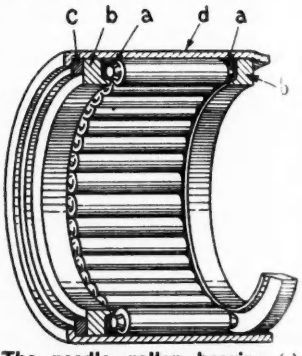
Six-unit taping machine with separate drive for each unit

Safety Handlamp

A new safety handlamp has been brought out by RUNBAKEN ELECTRIC PRODUCTS, 13-15, Liverpool Road, Deansgate, Manchester, 3. A double-wound transformer is built inside the adaptor, so that the handlamp is portable and needs no special installation. Its output is 12W at 6V and the cap is suitable for lampholders or two pin sockets. The transformer casing is moulded and the handlamp is of moulded rubber.

Needle Roller Bearings

The RANSOME AND MARLES BEARING CO., LTD., Newark-on-Trent, has introduced a form of needle roller bearings with trunnion ends which are designed to permit the retention more easily of the rollers during the fitting of a bearing. In the ordinary model the shoulders of the outer ring of the race provided for guiding the rollers are fitted with pressings. The trunnions resting on these pressings are thus retained in the outer ring.



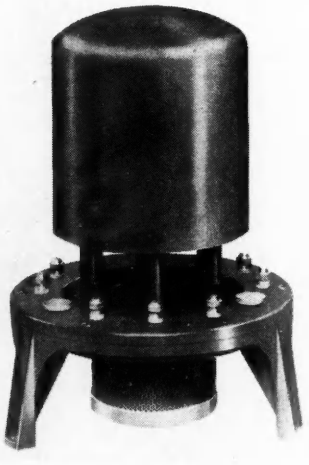
The needle roller bearing (a) rollers; (b) end plates; (c) spring ring; (d) metal cartridge

In a second design, intended for use where the rollers run between hardened and ground surfaces of a machine without the use of separate race rings, the rollers are held between formed end-plates which are designed to prevent them from falling towards the centre. A spring ring retains the assembly in position after the bearing is fitted, and the whole is held during assembly in a thin metal cartridge which is peened over at the spring end and retained in the cartridge by small notches at the other end. These notches are opened by pressure on the mandrel by which the cartridge is led into the recess where the rollers are to be assembled, and the spring ring snaps into a groove machined into the outer compartment.

Electric Fountain

The latest electric fountain unit of GRAHAM FARISH, LTD., Bromley, is arranged for connection direct to the mains and requires a minimum of only 3 in. of water to provide nine jets.

The waterproof 120-W motor is a 50-cycle capacitor start-and-run induction machine with a speed of between 2,600 and 2,800 RPM. The shaft is of stainless steel, and all the external metal work is stove enamelled. The ball bearings are packed in grease with an incorporated grease chamber containing a supply sufficient to last five years.



Graham Farish fountain

The pump itself is of an entirely new turbine construction with unrestricted take-off and an external pressure chamber into which the jets and three ½-in. outlets are fitted. The maximum output is 400 gallons per hr. against a head of 18 ft. with a maximum suction of 5 ft. using a pipe extension from the base. A filter of ample dimensions is fitted.

The three ½-in. outlets may be connected to other fittings, including waterfalls, etc., and the nine jets may be replaced by connections for ¼-in. rubber hose for additional effects, for the water output is considerably in excess of that required for the fountain alone. The dimensions are 11 in. high by 8 in. in diameter, with a jet ring 6 in. in diameter.

NEW BOOKS

Vector Analysis. Electricity in Mines. Electron Tubes.

An Introduction to Vector Analysis. By B. HAGUE. (Pp. 118; figs. 39.) Methuen & Co., Ltd., 36, Essex Street, London, W.C. Price 3s.

THE simple vector algebra with which electrical engineers are familiar has little in common with the method of vector analysis which has been so powerful a weapon in the development of modern physical theories. The vector algebra of the textbooks on AC technology is two-dimensional, and it is based upon a particular, but not unique, convention for the meaning of vector multiplication. Modern vector analysis, developed originally by Hamilton, is three-dimensional, and is based upon a multiplication convention which leads to a non-commutative algebra, in which a product depends not only upon the factors, but also upon the order in which these are multiplied.

Dr. Hague is well known to electrical engineers as a lucid and authoritative writer in the field of advanced AC technology. In this little book he has given a concise and illuminating account of the elements of modern vector analysis, starting from first principles and taking the student through the subjects of vector differentiation, secular and vector potential fields to the elements of the theory of tensors. The subject of vector analysis is one which can only be grasped by those having a well defined mathematical instinct. Anybody with this qualification who desires to acquire a knowledge of this important branch of mathematics will find, in Dr. Hague's little work, just what he needs.

The treatment is lucid, the illustrations are excellent, and the price of the book is very moderate. Those readers who desire to pursue their studies in the subject beyond the limits of the book will find some very useful hints in an explanatory bibliography which forms one of the appendices.—G. W. S.

Great Engineers. By C. MATSCHOSS. Translated from the German by H. S. Hatfield. (Pp. 381; figs. 44.) G. Bell & Sons, York House, Portugal Street, London, W.C.2. Price 12s. 6d.

This work purports to be a popular history of engineering and at the same time a series of studies of the lives and achievements of some of its leading practitioners over a period of 5,000 years. As it has been necessary to make a rigid selection of biographical subjects the general effect is to make the historical aspect appear somewhat scrappy and uncoordinated. The emphasis laid on the human side occupies space that for serious purposes might have been given to achievements.

Electrical engineers who figure most prominently are Werner von Siemens, Westinghouse, Oskar von Miller, Edison and Parsons. The names of Marconi, de Forest and Fleming appear once each. Ferranti is not mentioned and the Crompton referred to in passing is not Colonel R. E. B. but the spinning-machine man. Swan comes into the picture as one who was working on the incandescent lamp at the same time as Edison, but, it is said, the "practical success fell to Edison," a statement to which we must demur, if it implies that it was Edison's lamp and not Swan's earlier lamp that proved to be the practical success.—C. O. B.

Glover's Mining Handbook. (Pp. 323.) W. T. Glover & Co., Ltd., Trafford Park, Manchester.

The first edition of this handbook, issued in 1914 shortly after the existing electricity regulations were established at the mines, contained a modest 124 pages, whereas the present edition with its 323 pages, semi-flexible covers, rounded corners and pocket size (6¼ in. by 4¼ in.) bears the imprint of experience in these details as well as in the choice of matter and its arrangement. The preface makes the object of the handbook clear: "To combine under one cover the various regulations dealing with electricity in mines"—and, it might have been added, quarries—"with particular reference to cables."

The first 122 pages are devoted, very naturally, to the general regulations governing the use of electricity in coal mines, with explanatory notes—the well-known Mines and Quarries Form No. 11 (revised March, 1937). There is, of course, nothing new to be noted in these regulations, but there is a novelty of arrangement. The regulations applicable above and below ground have been combined in this edition. Those applicable both above and below ground are printed in ordinary type, those applicable below ground only in heavy type, and those above ground in italics. The distinctions made are very clear and the innovation is a convenience. The Mines Department might reasonably be urged to adopt this new convention themselves. These regulations, to which must now be added the form in which they appear, are the chief *raison d'être* of the handbook.

Other official regulations and memoranda include the new rules governing the use of electricity in metalliferous mines with memorandum (Mines and Quarries form 15B) and the new "Quarries General (Electricity) Regulations 1938," to which there are certain exemptions touching the construction of cables and apparatus in use before, July 1938.

There are also sections including official circulars and regulations in full, on (a) lighting in coal mines by safety lamps and other means, and (b) electric signalling and telephones. In addition, 40 pages of the handbook are devoted to quotations bearing upon the use of cables below ground from H.M. Electrical Inspector of Mines' reports covering the fifteen years 1923-1937. Another section deals with trailing cables, regarding which no one can speak with greater authority than the author who is a member of Glover's staff.

In short, we know of no better handbook for those concerned with the use of electricity at mines and quarries, quite apart from the wealth of experience behind the practical hints, whether official or unofficial, which are scattered freely throughout the handbook. A very useful publication.—R. N.

Theory and Application of Electron Tubes. By H. J. REICH. (Pp. 670; illus.). McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2.

The volume under review might serve as a textbook not only for those already having some knowledge of the subject, but also for students taking advanced engineering courses. The author deals, in a refreshing manner, with a wide variety of subjects some of which are summarised below.

In the section on the theory of electron tubes Dr. Reich outlines the conceptions and principles underlying the behaviour of many different types of electronic device. The value of these chapters lies in the fact that the method of presentation enables the reader to co-ordinate current theories with the behaviour of electron tubes in practice. They should, therefore, be stimulating both to the student and to the research engineer. The author has not only had at his disposal a very considerable amount of data, but he has presented it in a most readable way.

After discussion of physical concepts, thermionic emission and the grid-control of high-vacuum tubes, succeeding chapters deal with methods of analysing tube characteristics, modulation, detection and amplification and the basic principles involved in these applications of electron tubes are clearly set out. In addition, this first section of the book details the principal kinds of vacuum-tube oscillators and their characteristics.

Commencing with Chapter 11, the author discusses the fundamental phenomena of gaseous electrical conduction and its application in the design of light sources, rectifiers, and other types of glow and arc discharge tubes. The use of electronic tubes for power control, electrical measurements and light-sensitive devices is treated in separate chapters. These sections do not purport to be exhaustive, but they form an adequate introduction, and useful bibliographies will enable the interested student to seek further information from the original publications.

This book can be recommended to all who wish to obtain an adequate grounding in the fundamental principles of electronic tubes and an understanding of many typical applications. It will be a valuable addition to any technical library.—J. N. C.

Shorter Notices

"Statistical Year Book of the World Power Conference," No. 3. (Pp. 137.) World Power Conference, 36, Kingsway, London, W.C.2. Price 20s.—The new year book contains figures for 1935 and 1936 and relates as before to the production of all kinds of solid fuels, liquid fuels, gaseous fuels, electricity, and water power. Gross capacities of developed reservoir sites in thousands of kWh at 100 p.c. efficiency showed Norway leading with 6,300,000, and Sweden with 968,000 in 1935, rising to 6,350,000 and 1,261,000 respectively in 1936. In the statistics of electricity production it is very unfortunate that the figures for Germany have been omitted for 1936 as in 1935 it is shown as almost the biggest European producer—Germany, 20,525 million kWh, U.S.S.R., 25,900, Great Britain, 17,970, and France, 11,825.

"Manual for Executives and Foremen," by E. H. Schell and F. F. Gilmore. (Pp. 185.) McGraw Hill Publishing Co., Aldwych House, London, W.C.2. Price 12s.—This book is simply arranged and endeavours to assist the executive to ensure the efficient working of his factory. The book opens with chapters describing various processes, passing on to the workplace, the work itself, and the worker. Other chapters deal with quality, quantity, equipment and storage while at the end are a bibliography and index.

"Chemistry," by H. G. Lambert and P. E. Andrews. (Pp. 247; figs. 69.) University Tutorial Press, St. Giles High Street, London, W.C.2. Price 2s. 9d.—Although low in price this volume contains a comprehensive introductory course to chemistry for junior forms in secondary schools. It is straightforward in treatment, diagrams are clear and formulæ appear to have been reduced to a minimum.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

A SUCCESSFUL golf tournament was held by the North-Western Centre of the I.E.E. at the Sandiway Golf Club, on May 18th, from which the I.E.E. Benevolent Fund will benefit by approximately £120. The dinner in the evening and prize-giving were presided over by the chairman of the Centre, **Mr. W. Fennell.** One member of the Centre, Mr. G. Cluley, had the distinction of holing out in one at the 6th hole (135 yards) and he suitably celebrated his achievement by making a further contribution to the funds.

Mr. C. T. Allan, M.I.E.E., F.R.H.S., is retiring from the position of assistant manager of the South Wales Electric Power Co. at the end of the current month. Born at Wakefield. Mr. Allan received his education at St. Johns College, near Preston, Wakefield Grammar School, Walker Engineering College. Liverpool, and Finsbury Technical College. His first important position was as engineer with the New Explosives Co., Stowmarket, from which he joined the British Westinghouse E. & M. Co. as engineer on work at home and abroad, and put into service the first electric locomotive in Sweden. In Great Britain he was responsible for the erection of plant at Willesden, Bankside, &c., and carried out a great deal of work in connection with tramways and underground railways in London, and with steel works, collieries, and other industries. Mr. Allan joined the South Wales Electric Power Co. in 1905. He was hon. secretary of the Western Centre of the I.E.E. for sixteen years, until 1930, and has served on many committees, including B.S.I., E.R.A., and E.D.A.

Mr. C. T. Allan

Mr. M. W. Singer, A.M.I.E.E., has been appointed agent in Great Britain for William Kent, Burslem, manufacturers of porcelain insulators and refractories. His address is 149, College Road, Moseley, Birmingham, 13 (telephone : Springfield 1942).

Mr. W. Rawnsley has been appointed control engineer with the Croydon Corporation Electricity Department in succession to Mr. R. A. Park, who has resigned. Mr. Rawnsley was previously in the control room of Halifax Corporation Electricity Department.

The North Midland Centre of the Institution of Electrical Engineers is holding a golf competition on June 27th in aid of the I.E.E. Benevolent Fund, on the links of the Moortown Golf Club, Leeds. The entrance fee for the tournament is 2s. 6d. each player, plus an entrance fee of 2s. 6d. for competitions Nos. 1 and 2, and 1s. for competition No. 3. A number of electrical concerns are giving donations and prizes. Following the tournament there will be a dinner at the Club House, tickets for which are 5s. each. Further particulars can be obtained from Mr. J. N. Jones, hon. secretary of the golf competition, Magnet House, Wellington Street, Leeds.

Mr. S. Hutchinson, district representative at Stratford-on-Avon, of the Shropshire, Worcestershire and Staffordshire Electric Power Co. since the end of 1937, has been appointed to a similar post at Evesham. In conjunction with Mr. R. Baker he had charge of the electrical installation at the Stratford Memorial Theatre. He is succeeded by **Mr. A. S. Brand** of Redditch.

Mr. F. Walker, electrical engineer to Boots Pure Drug Co., Ltd., is the chairman-elect of the recently formed Midland Sub-Centre of the Illuminating Engineering Society at Nottingham. **Mr. C. S. Caunt,** of the General Electric Co., Ltd., Nottingham, is the hon. secretary.

Ald. A. Sturgess, chairman of the Derby Electricity Committee, has been appointed chairman of the employers' side of the Joint Council and Joint Board for the Electricity Supply Industry (No. 7 District), which includes, Derby, Nottingham, Leicester and other centres.

Mr. D. M. McKechnie, resident engineer and manager of the Peterhead Electricity Co., Ltd., for the past four years, has joined the staff of the Bagdad Lighting and Power Co., Ltd. He will be stationed at Brussels for a few months before going to Bagdad. Mr. McKechnie will be succeeded at Peterhead by **Mr. P. Kirkwood,** a former manager of the Peterhead Co.

Mr. R. J. Leonard, of the Bective Electric Co. (Ireland), Ltd., was re-elected president of the Dublin branch of the Electrical Contractors' Association at the recent annual meeting held in Dublin.

Mr. J. E. Hart, Grad. I.E.E., at present assistant installation and consumers' engineer with the Barking Corporation, has been appointed consumers' engineer in the Shoreditch Electricity Department. Mr. Hart served his apprenticeship with Rugby Corporation where for three years he was in charge of testing. Prior to going to Barking he was with the Islington Borough Council.

At the annual general meeting of the Institute of Physics held on May 17th, **Prof. W. L. Bragg** was elected president for the session 1939-40; Prof. A. Ferguson was elected vice-president, Major C. E. S. Phillips hon. treasurer and Prof. J. A. Crowther hon. secretary The new members of the board are Dr. H. Lowery and Mr. R. S. Whipple; and Mr. J. H. Awbery (appointed by the Physical Society).

Mr. E. B. Moullin, M.A., of Oxford University, has been nominated for the chairmanship of the Wireless Section of the Institution of Electrical Engineers for the session 1939-40.

Mr. D. J. Thomas has been elected president of the South Wales branch of the Association of Mining Electrical Engineers for the new session.

Mr. J. J. Smith, A.M.I.E.E., was elected chairman of the Association of Supervising Electrical Engineers for the ensuing year, at a meeting of the Executive Council of the Association, held on May 8th. **Mr. F. W. Smith** was elected vice-chairman and **Mr. R. F. Appleyard,** hon. treasurer.

Dr. J. D. Cockcroft, F.R.S., whose election to the Jacksonian professorship of natural philosophy in the University of Cambridge is reported in *Nature*, gained experience in heavy electrical engineering early in his career, and entered St. John's College from the University of Manchester as Dowman Sizar and Hoare Exhibitioner in Mathematics in 1922. He was engaged in research in Cambridge, first of a mathematical nature, concerning the heating of transformer coils and later, at the Cavendish Laboratory, of an experimental character regarding the deposition of surface films by atomic beams. He took his Ph.D. and was elected a fellow of St. John's College in 1928. He was largely responsible with Kapitza, for the design of much of the equipment used in the production of intense magnetic fields, and, with Walton, of the arrangement by which nuclear disintegration was first effected by artificially accelerated particles. More recently he has been the moving spirit in the construction of the Cambridge cyclotron, and he has taken over the major work of supervision of the building operations made possible by Lord Austin's bequest.

Lafayette

Dr. J. D. Cockcroft

The annual dinner of the Clacton U.D.C. Electricity Department sports club was held recently at the Glengariff, Clacton, under the presidency of **Mr. G. Broadhurst,** the electrical engineer. The toast of "The Club" was proposed by Mr. H. P. King, who said that they had had a very successful season. Mr. F. A. White, in responding, briefly referred to their successes. The toast of "The President and Vice-Presidents" was proposed by Mr. F. Crush, and Mr. Broadhurst replied. Mrs. G. Broadhurst presented the cups and other awards to the winners of the various competitions.

The football team of William Geipel, Ltd., has had another good season, their successes including the championship of the Harrow and District League (premier division) and the Wembley Hospital Cup, beating McVitie & Price, Ltd., in the final by 5 goals to 4. They were also runners-up for the Harrow Charity Cup. The annual dinner and dance of the club was held recently, at which **Mr. K. S. Geipel,** the president, congratulated the club on their performance.

Mr. D. J. Bolton, M.Sc., M.I.E.E. lecturer in electrical engineering at the Polytechnic, Regent Street, London, W., sails to-day (Friday) on the M.V. *Shropshire* for Burma, where he will advise the Rangoon Electric Tramway & Supply Co. regarding electricity rates. He will be away for about four months.

Mrs. Jean Roberts, convener of the Glasgow Corporation Electricity Committee, has been appointed chairman of the Joint Industrial Council for the Electricity Supply Industry in Scotland, and is the first woman to hold the position. She has also been appointed Scotland's representative on the National Council for the Electricity Supply Industry.

Mr. A. H. Young has been elected chairman of the London Students' Section of the Institution of Electrical Engineers for the 1939-40 session.

Alderman D. Stuart, vice-chairman of the London & Home Counties Joint Electricity Authority, who underwent a serious operation last month, has now been able to leave hospital and return home, and is making a steady recovery. He desires to thank his friends for their many kind inquiries and good wishes.

Shipley Urban District Council has appointed **Mr. N. L. Duncan,** of Swinton, as electrical engineer at a salary of £600 per annum.

Lord Rankeillour has joined the board of the Metropolitan-Cammell Carriage & Wagon Co. He is a director of a number of companies, including the Jerusalem Electric & Public Service Corporation.

Obituary

Mr. R. C. Lanphier, senior, president of the Sangamo Electric Co., Springfield, Illinois, U.S.A., whose death occurred recently, graduated from Yale University in 1897 and after completing two years' research work, founded the company of which he was president and which only recently celebrated its fortieth anniversary. He was recognised as one of the foremost electrical engineers in the United States and during a long and distinguished career was associated with a number of world famous men including Thomas A. Edison.

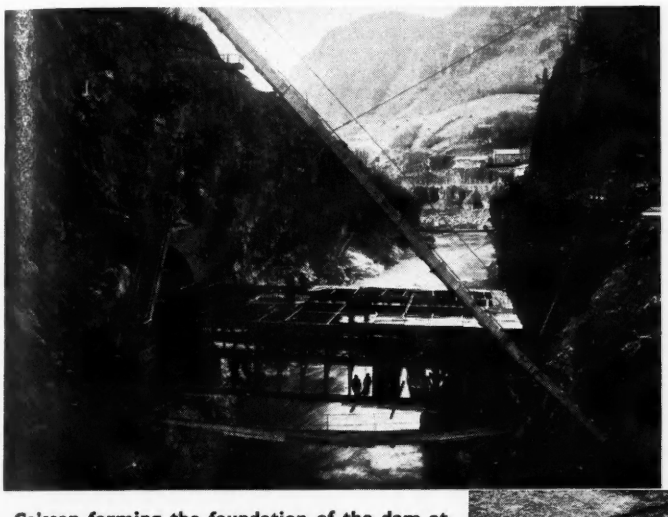
Wills.—Mr. Francis Henry Wheeler, a director of F. H. Wheeler & Co., Ltd., registered installation contractors, left £59,443 with net personalty £36,759.

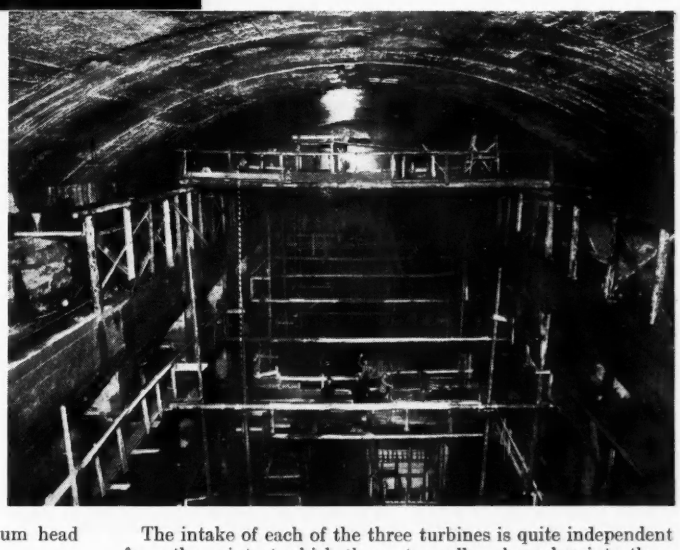
Mr. C. Darrah, chairman of Baxendale & Co., left £85,586 (net personalty £79,159).

An Italian Water-power Scheme

Underground Plant

THE construction of the Santa Lucia water-power plant on the Isonzo River, in the extreme north-east of Italy, presents several interesting characteristics. In the first place, the plant is completely underground for protection against attacks from the air. Secondly, the dam built to store water for the turbines was constructed on foundations let into the rocky walls of the valley *above* the normal level of the river. The reason for this procedure was that the considerable variations in the flow of the river made it impracticable to provide deviation canals for the full maximum flow. Instead, a temporary dam was built upstream to permit of the deviation of a capacity sufficient only to take care of moderately high waters.





Caisson forming the foundation of the dam at Santa Lucia, on the Isonzo River, and a view of the machine room

A heavy steel box girder was then built across the valley and set into the side walls, 5 metres above the river level. The dam was then raised up on this girder, while the foundations were built below it. The main construction work could thus be carried out at all times, while the foundations were built only when the flow of water was sufficiently low to pass through the deviation gallery.

The height of the dam is 53 m. above the bedrock and 40 m. above the original river bed. Its length at the top is 33.86 m., so that it provides a minimum head of 41 m. and a maximum head of 45 m.

The connection between the reservoir and the plant is formed by a circular gallery 3,875 m. long and of 5.6 m. inside diameter. Most of the rock being compact and without fissures, the lining of the gallery is formed of a 25-cm. thick layer of concrete, smoothed internally by hand. Elsewhere a 22-cm. layer of concrete with a facing of 3 cm. of "gunite" was used, while at a few places where the rock seemed less certain 17 cm. of concrete and 8 cm. of reinforced "gunite" was applied.

An open well and an oval expansion chamber are provided at the end of this gallery. The expansion chamber has two outlets: one at the bottom branches into three parts for feeding the three turbines and the other at the top runs back to the river below the plant and carries off any excess water.

The machine room was excavated out of the bedrock. It is 39 m. long and 14 m. wide with a height of 16 m. at the centre of the arched ceiling. An 80-ton travelling crane has been installed at a height of 11 m. above floor level, making this the greatest usable height. The top of the roof is 12 m. below ground level and the outer wall 150 m. from the centre line of the river.

Three wells, one for each turbine, were sunk into the floor; each is 16.5 m. deep, 9.5 m. long and 9.3 m. wide.

The vertical-shaft Francis type turbines of 11,500 kW are coupled to alternators of 15,000 kVA, giving the plant a mean productive capacity of 135,000,000 kWh per year.

From each of the machine wells a gallery runs to a sub-station hollowed out of the face of the cliff. Three transformers of 10/135 kV and 15,000 kVA are each housed in a separate dug-out cell in the hillside. In front of these a repair shop and offices have been erected.

Two tunnels connect the repair shop with the plant. One of these serves for the transport of machinery and the other as an entrance for employees. These galleries, together with two others opening into the machine room near the roof, serve also for ventilation purposes.

The intake of each of the three turbines is quite independent from the point at which the water gallery branches into three parts. Each branch is provided with a cylindro-spherical valve, permitting the water to be cut off independently from any one of the three turbines. Each turbine also has an independent runway by which the used water is restored to the river below the power house. Since the openings of these runways may at times be below water level (in case of high water) the turbines have been designed to work against back pressure and with an efficiency of about 80 per cent. of normal.

Normal flood water of the Isonzo River is taken care of by two surface canals, each capable of a flow of 566 cubic metres per second, and two underground tunnels each capable of discharging 1,940 cubic metres per second.

COMMERCIAL AND INDUSTRIAL NEWS

New Bridlington Showrooms. E.L.M.A. Street Lighting Conference. Agricultural Electrical Displays. Two Carnival Tableaux. A London Cinema Lighting Installation.

Bristol Electric Vehicle Exhibition

ASSOCIATED ELECTRIC VEHICLE MANUFACTURERS, LTD., in conjunction with their Bristol depôt (Hants Electric Chassis, Ltd.), are holding a comprehensive display of electric vehicles at Bristol from June 5th to 10th. The range will include Morrisons with carrying capacities of 8 cwt. to 40 cwt., Electricar heavy road vehicles, including refuse collectors, factory trucks, and vehicles specially adapted for municipal use, such as tower wagons. There will also be a luncheon on June 6th.

Electrifying a Clearing Yard

The Toton clearing yard on the L.M.S. at Long Eaton is the largest in Great Britain and the first to be mechanised. Sixty engines per day (out of 165 allocated to Toton) are booked to work in the 55 miles of sidings, shunting and working empty wagons to local collieries, and any delays would affect almost the whole of the L.M.S. Midland Division. The staff includes

Cabling at Toton clearing yard showing a 34-core cable completed ready for jointing

200 goods guards, 250 crews of engine drivers and firemen, and 240 men for shunting. Between 8,000 and 9,000 wagons are normally put over the two single "humps" in 24 hours.

Approximately 2,330 yd. of multicore paper-insulated cables were laid for main controls and 6,000 yd. multicore rubber-insulated signalling cables, all s.w.a., with an anti-corrosive finish for laying direct into the ground, which is composed of chemically active ashes and ballast; also 17,000 yd. of fire-proofed and braided cables were used for wiring the control panels and relays. One of the accessory cases houses three main control cables (one 34-core and two 42-core) and forty-nine auxiliary cables, the total number of wires being 238. The whole of the work was completed by the General Railway Signal Co., Ltd., and Callender's Cable & Construction Co., Ltd., without interrupting normal working.

New Bridlington Showrooms

The new offices and showrooms of the Bridlington Corporation Electricity Department were formally inaugurated on May 18th by Ald. A. E. Fligg (chairman of the Electricity Committee). Ald J. W. Robson (the Mayor) said he did not know of any other town of the size of Bridlington that had made such progress, at any rate during the past ten years. Tariffs had been reduced from time to time, and the average price obtained for all electricity to-day was 1.7d. per kWh as compared with 4.1d. per kWh ten years ago. The tariffs of Bridlington compared favourably with any other town. Ald. Holmes paid tribute to the work of Capt. A. J. Beckett, the borough electrical engineer.

Owing to the rapid growth of the electricity undertaking it has been difficult to find accommodation for the staff, and the new premises in Quay Road, beside serving as showrooms, will house the whole of the executive, clerical and engineering staff. Attractive display windows and an illuminated sign on the facia command the attention of passers-by. In the main showroom on the ground floor are showcases with concealed lighting, while other rooms on this floor are an interview room, committee room, general office, staff and meter rooms. A feature of the first floor is a large demonstration hall which will seat 150 people, and is equipped with a lecture platform fitted with cookers, cabinets and other appliances. There are also show kitchens, working kitchens, drawing office and staff rooms on this floor. The building is heated by a system of panel heaters incorporated in skirting around the various rooms. Ceiling panels are used in the showroom.

E.D.A. Activities

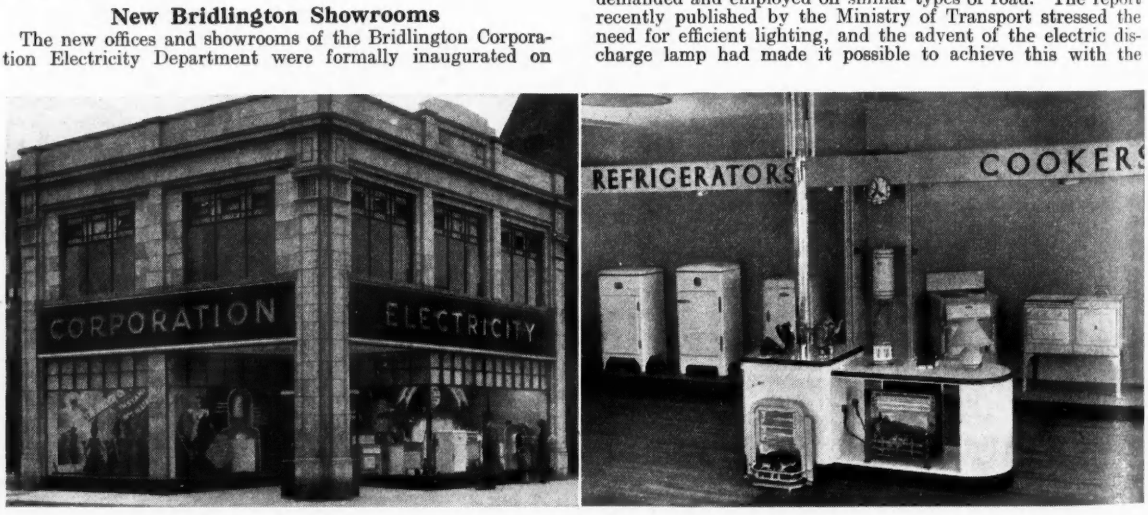
Attention is again drawn in the June sales and publicity programme of E.D.A. to the 1939 carnival car, bookings for which are now rapidly coming in. Special reference is also made to the national cooking campaign which commences next month, and in addition to the publicity material already circulated three recipe books are available entitled "Cooking with Confidence," "The Way to a Good Table," and "Teatime Recipes." A price list is enclosed of booklets, &c., which are available for distribution to the public.

E.P.E.A. Diplomas

Some time ago the Electrical Power Engineers' Association decided to institute diplomas in connection with its correspondence tuition scheme after a stringent test. The first examinations under this scheme were held at the end of last year and as a result diplomas have been awarded to seven members—three in electrical engineering salesmanship and economics, three in electrical technology and one in electricity supply (generation).

Electric Street Lighting Conference

An Electric Street Lighting Conference was held last week at the E.L.M.A. Lighting Service Bureau. Mr. Morley New, Electricity Commissioner, in opening the conference, said that it required little intelligence to realise the more obvious advantages of electric street lighting, of which prevention of crime was by no means the least, but there were many highly technical points which needed explanation, and it was to these that the attention of the conference was to be directed. Until recently street lighting had been most haphazard, but it had been good in those areas where the rateable value was high and poor in the less fortunate districts. As nowadays the chief aim of street lighting was to facilitate traffic flow and prevent accidents, it was essential that a uniform standard should be demanded and employed on similar types of road. The report recently published by the Ministry of Transport stressed the need for efficient lighting, and the advent of the electric discharge lamp had made it possible to achieve this with the



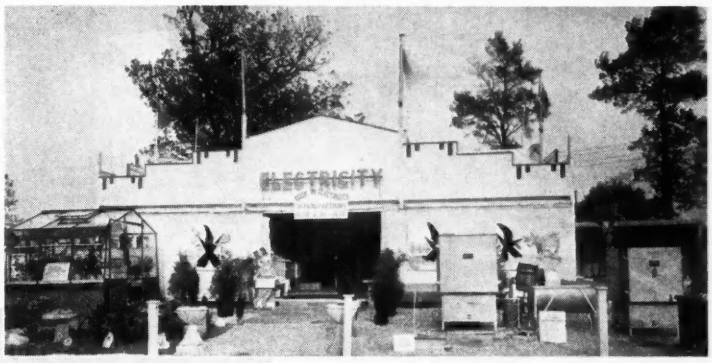
The new showrooms of the Bridlington Electricity Department showing (right), the attractive exterior and (left), the refrigerator and cooker section

utmost economy. Mr. L. J. Davies then spoke on "The Recent Developments in Electric Discharge Lamps and Street Lighting Lantern Design," and later Mr. G. H. Wilson showed how modern street lighting technique made use of the specular nature of modern road surfaces and demonstrated an ingenious system whereby photographs of two lighted street lighting fittings taken at different ranges could be projected on to a screen and the positions where they best lighted the road surface determined. In the afternoon Messrs. C. R. Bicknell and J. G. Christopher presented a joint paper on "The Advantages of Electric Street Lighting."

Electricity at Agricultural Shows

The Devon County Agricultural Show, which was held at Axminster from May 16th to 18th, included a comprehensive display of electrical equipment both for agriculture and for the home. The electrical display was organised by E.D.A. in co-operation with the electricity supply authorities in Devon. On the stand itself there was a wide range of domestic electrical appliances and commercial exhibits, a part of the stand being partitioned off and used as a demonstration lounge.

In the open space many of the rural applications of electricity were shown. A feature of this display was the G.E.C. equipment, including an electric sterilising chest for which the company was awarded a silver medal. The company was also awarded a bronze medal for its display of sterilising equipment. Other electrical applications were poultry plucking, egg grading, dairy equipment, small barn machinery, pumps, a greenhouse equipped with tubular heating and irradiation lamps, and soil heating. In the garden there were also shown an electric lawn mower, hedge clipper and fountain pump.



Two electrical displays at agricultural shows illustrating (top) G.E.C. equipment at the combined display at the Devon Show and (below) the Oxford Electric Supply Department's stand at the Oxfordshire Show

The electrical exhibit at the Oxfordshire Agricultural Show held from May 18th to 20th was arranged by the Oxford Corporation Electric Supply Department. This was in four separate sections with a lounge in the middle. Fountains were playing on the front lawn and the illuminated pylons formed an effective decoration. In sending us the accompanying illustration of the exhibit, Mr. H. G. Fraser, the city electrical engineer and manager, states that the display was visited by some hundreds of people and the continuous baking demonstrations prove a great attraction.

Employment in April

Employment showed a further improvement between March 13th and April 17th in all the principal sections of the engineering industry, and remained good in electrical engineering. According to the *Ministry of Labour Gazette*, the number of unemployed in the engineering industry fell to 76,758, a decrease of 4,492 as compared with the preceding month, the percentage falling from 6.5 to 6.1 (6.6 in April, 1938). The number out of work in the electrical engineering industry was 5,575, or 4.7 per cent., a fall of 0.4 per cent., as compared with March and with April, 1938. In the electrical wiring and contracting industry there were 4,424 out of work, the percentage (10.4) showing a decrease of 0.4 as compared with March and 0.2 per cent. as compared with April, 1938. The electric cable, apparatus, lamps, &c., group, showed a slight increase at 13,231 (7.4 per cent.), as compared with 7.1 per cent. in March, but a decrease of 1.9 per cent. as compared with April, 1938.

Works Visits

Over a hundred members, and ladies, of the South Wales Branch of the Association of Mining Electrical Engineers visited the factory of Aberdare Cables, Ltd., on May 18th, headed by branch president Mr. Joseph Jones, and were greeted by Mr. T. Elder, works manager, and Mr. H. de Falle, sales manager. The company specialises in paper insulated cables for all power purposes up to and including 11,000 V. It has been in production for only about twelve months, but three shifts per day are being worked, giving employment to about 200 local men. Following the inspection of the works the party was entertained at tea at the Mona Café, Aberdare. The branch annual general meeting followed, at which the hon. secretary, Mr. H. J. Norton, reported an increase in membership of the branch; since the beginning of the present year about fifty new members had joined. He attributed this increase to the fact that a number of colliery companies were recommending them to join the Association. Mr. Norton said there were probably still 150 colliery men who were eligible for membership but had not yet joined. In December last eighteen members presented themselves for the new oral examinations; seventeen gained grade "A" certificates and one a grade "B." Further oral examinations were held in April, and a final one will take place, probably, in September next. Certificates were presented to the eighteen successful candidates by Mr. S. B. Haslam, national vice-president.

A visit was paid recently by members of the Institution of Railway Signal Engineers to the lamp works of the Edison Swan Electric Co., Ltd. The party, which included Mr. J. Boot (president) and Mr. H. A. Moore (vice-president), was shown the various stages of lamp manufacture, special attention being given to the processes in the production of signal lamps.

Trade Announcement

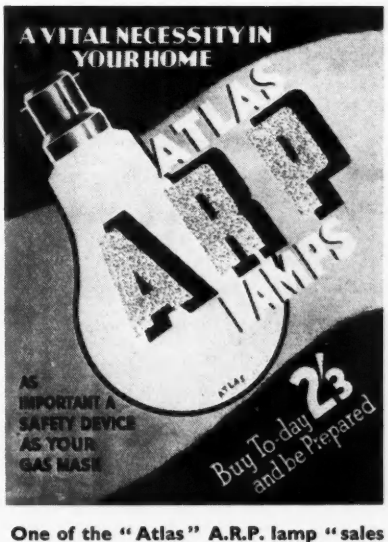
The plastic moulding section of Thomas de la Rue & Co., Ltd., has been removed to Avenue Works, Walthamstow Avenue, North Circular Road, E.4 (telephone: Larkswood 2323).

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable-making Industry announces that the cost of living figures on May 1st (53 per cent. above the 1914 level) will not involve any alteration in wages on the third payday in June.

Lamp Publicity

In our issue of April 28th we mentioned that Thorn Electrical Industries, Ltd., had produced a new "Atlas" lamp designed for use in air-raid conditions. The company has now prepared three attractively coloured sales aids for the use of dealers stocking the lamps. These take the form of a window bill, a showcard (seen in the accompanying illustration) and a descriptive folder.



One of the "Atlas" A.R.P. lamp "sales aids"

Control Equipment at the World's Fair

The map in the Canadian Pavilion at the New York World's Fair is constructed of copper-faced panels, having indicator lamps inserted at points on the map to indicate thirteen groups of places such as capital cities, universities, manufacturing centres and principal broadcasting stations. In order to indicate which group of lamps is illustrated, specially constructed box type signs are situated near the top of the map at each side, the lettering being illuminated by neon tubing. Thus the first group is capital cities, and the corresponding key lamp lights up with the indicator lamps at each capital city on the map. The control gear provided by the Igranic Electric Co., Ltd., comprises a contactor panel and a control station. In addition a pilot motor-driven "flasher" controls the period during which each group of lamps is alight when the apparatus is not running under manual control. The contactor panel carries thirteen multi-pole contactors, one for each group. These contactors have a similar number of normally open contacts. An additional latched contactor with thirteen normally open and thirteen normally closed contacts is provided to change over the circuits, depending upon whether the lamp groups are under "flasher" or "manual" control. The selector switch, shown in the accompanying picture, has thirteen positions corresponding with the thirteen groups and also has four push-buttons marked "On," "Off," "Manual" and "Flasher."

An Igranic selector switch as used in the Canadian Pavilion at the World's Fair

German Machinery Regulations

According to the *E.T.Z.* a new series of regulations regarding the design and construction of electrical machinery intended for use in buildings in which there are dangers of explosion has recently been drawn up by the Verband Deutscher Elektrotechniker. The new regulations define the methods of protection against such risks that must be taken, a classification of gases and vapours according to their degree of danger, and details regarding the armouring of machines and apparatus against explosion pressure. All anti-explosion material is required to pass through a certain number of tests stipulated in the regulations.

Two Electrical Tableaux

A feature of the recent Streatham Shopping Week was an industry procession which was held on the last day. A large number of local industries took part including the County of London Electric Supply Co., Ltd., which, as our picture shows, cleverly linked up the recruiting campaign with advice to protect food by electric refrigeration.

The illustration on the right shows an exhibit entered by the Colwyn Bay Electricity Department in the Colwyn Bay annual May Day procession which was awarded the second prize.

The Contractors' Conference

In our last issue we mentioned that there would be only one paper read at the E.C.A. Conference (June 28th-30th at Brighton). Actually this will be a five-fold paper entitled "Advances in Installation Practice," dealing with the following subjects:—"Low Voltage Distribution" (Major P. A. Smith); "Air-insulated Bar Distribution" (Mr. Robert Marryat); "Duct Systems" (Mr. E. Jacobi); "Accessories" (Mr. E. A. Reynolds); and "Earthing" (Mr. T. C. Gilbert).

New Darlington Showrooms

Estimated to have cost £10,000, the new offices for Darlington Corporation Electricity Department in Naughton Road have now been taken over by the borough electrical engineer (Mr. T. E. Daniel) and his staff. The premises replace the old offices in the south-east corner of the trolley-bus depôt. They have been built to the design of the Electricity Department by Mr. L. C. Abdale and the work was carried out under the supervision of the borough surveyor, Mr. E. Minors. The offices are warmed by tubular and convector heaters, thermostatically controlled. In the drawing offices the lights are shadowless and different types are provided in each office. The garage, which is in the basement, has a thick concrete roof and in the event of an emergency would be covered with sandbags and used as a shelter for the staff. Inside the garage is a small cubicle designed for use as a control room.

Radio Marketing Trade Annual

The 1939 edition of the "Radio Marketing Trade Annual," just published by "Radio and Electrical Marketing" of 29, Bedford Street, Strand, London, W.C.2, at 5s., post free, consists of 192 pages of reference matter and covers every aspect of the radio industry. There are three sections, commercial and legal, technical, and directory. A feature of the technical part of the annual is a complete new television servicing section occupying thirty-two pages.

"Selling Light"

The spring number of "Selling Light" (Philips Lamps, Ltd.), in addition to containing a number of interesting articles on the application of Philips lamps for various systems of lighting includes an article by Prof. A. L. Mellanby, D.Sc., LL.D., on "The £ s. d. of Lighting."

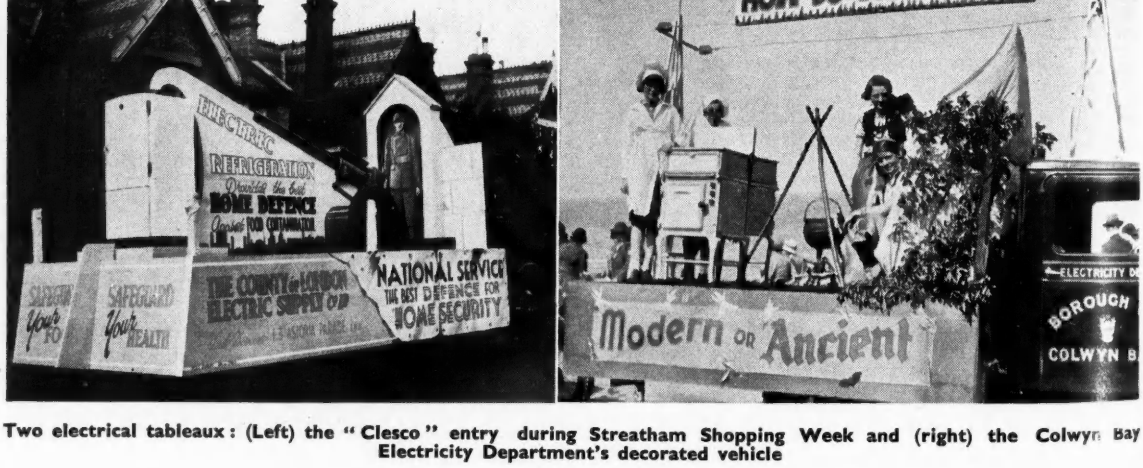
Equipment for L.P.T.B.

The London Passenger Transport Board has recently placed with the British Thomson-Houston Co., Ltd., two important orders for sub-station equipment in connection with the extension of the Central Line to Ruislip. The first of these orders comprises four air-cooled steel tank rectifier equipments of 2,000 kW capacity, each with associated AC and DC switchgear for installation in a new building at Notting Hill Gate, where they will replace some old rotary convertors housed in a lift shaft, and will augment the supply at present obtained. The rectifiers will operate 12 phase, taking a supply at 11,000 V, 33⅓ cycles, alternative feeds from Lots Road and Neasden power stations being available; they will be arranged for ready conversion to 50-cycle operation at a later date. The sub-station will be manually operated by a staff of attendants.

The second contract covers a total of twelve 1,500-kW water-cooled rectifiers with associated AC and DC switchgear to be installed in five sub-stations between Old Oak Common and Ruislip. These also will be 12-phase equipments but the incoming supply will be at 22,000 V, 50 cycles. The sub-stations will be operated from a control room by means of supervisory gear.

Flameproof Apparatus

The customary schedule of certificates of flameproof enclosure of electrical apparatus issued by the Mines Department during the three months ended March 31st, 1939, is now available. At the request of British Electrical and Allied Manufacturers' Association a few copies of these quarterly lists can be



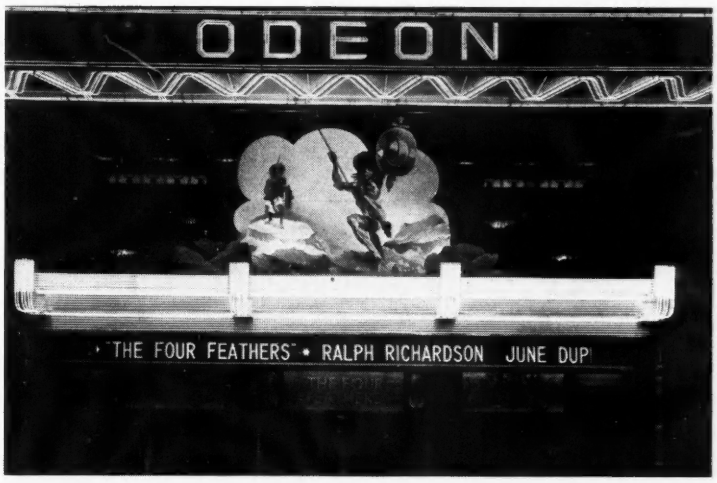
Two electrical tableaux: (Left) the "Clesco" entry during Streatham Shopping Week and (right) the Colwyn Bay Electricity Department's decorated vehicle

obtained at the price of 1s. 2d., post free, from the Mines Department, Dean Stanley Street, London, S.W.1.

Lighting at a London Cinema

Throughout the ever-widening Odeon circuit, "Mazda" lamps are used exclusively for all general and decorative interior lighting. The British Thomson-Houston Co., Ltd., has recently completed at the Odeon, Leicester Square, a very effective exterior lighting installation with the new "Mazda" fluorescent tubes. The main entrance and side canopies are illuminated by more than 1,300 ft. of white and blue tubes, giving a "daylight" effect.

Mazda fluorescent tubes are 20 mm. in diameter and are available in a wide range of colours and practically any desired shade can be obtained simply by selecting the appropriate fluorescent material for the inner coating. They are very suitable for interior lighting.



The new "Mazda" fluorescent tube installation at the Odeon, Leicester Square

An Illumination Booklet

The new edition of "Realumination," which has just been issued by Rowlands Electrical Accessories, Ltd., contains a wealth of information for everyone interested in lighting. There are 160 pages which include much technical detail; data for practically every type of industrial lighting installation is given, and there is a useful discharge lamp comparison table on page 43. Shop window, display lighting and colour corrected mercury lighting and floodlighting are dealt with fully.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price May 24th	Fortnight's inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£37	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax... ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 8s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium, Bichromate, casks ... per lb.	4¼d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£94	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/2½ to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£197	—
Grade II ... ... ,,	£137	—
Grade III ... ... ,,	£73	—
c Brass (rolled metal 2" to 12" basis)... per lb.	8¼d.	—
c ,, Tubes (solid drawn) ... ... ,,	11¼d. to 11¾d.	—
c ,, Wire, basis ... ... ,,	8¼d.	—
c Copper Tubes (solid drawn) ... ,,	1/0¾d.	—
g ,, Bars (best selected) ... per ton	£78	—
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£47 15s.	£1 dec.
d ,, ,, Wire Rods ... ,,	£52 10s.	£1 dec.
d ,, ,, H.C. Wire ... per lb.	7¾d.	¼d. dec.
f Ebonite Rod ¼" dia. & up. ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up. ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	Nom.	—
h India-rubber, Para-fine ... ... ,,	7½d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 15s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£16 10s.	—
g Mercury ... ... per bot.	£16	£1 15s. dec.
e Mica (in original cases) small ... per lb.	1/– to 2/6	—
e ,, ,, ,, medium ... ,,	7/6 to 15/–	—
e ,, ,, ,, large ... ,,	17/6 to 22/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1d.	—
p ,, ,, rolled strip & sheet ,,	11¼d.	—
p ,, ,, wire ... ... ,,	1/1¾d.	—
o Platinum ... ... per oz.	£7 10s.	—
d Silicium Bronze Wire ... ... per lb.	8¾d.	¼d. inc
g Spelter ... ... per ton	£13 13s. 9d.	1s. 3d. inc.
g Tin, Block (English) ... ... ,,	£225 5s.	10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

It should be noted that prices quoted for copper do not include any allowance for insurance against war risks.

Television Lectures

A course of four lectures on television will be given by Mr. H. J. Barton-Chapple, on Thursdays, commencing June 8th, at the Polytechnic, Regent Street, London, W.1. Demonstrations of high-definition television will be given, including the reception of the B.B.C. television service at each lecture. The fee for the course is 6s.

New Catalogues and Lists

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.—Details of the "Traffoblack" air-raid lighting system for factories.

Renold & Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester, 20.—A folder dealing with flexible couplings.

Albert Taylor (Manchester), Ltd., Quay Street, Manchester 3.—A price list of electrical insulating materials.

Sloan Electrical Co., Ltd., 54, 55, Fetter Lane, London, E.C.4.—A catalogue of A.R.P. equipment.

Electro-Mechanical Supplies, Ltd., 44, Bayley Lane, Coventry.—A catalogue dealing with the "EMS" distribution troughing system and a low-voltage lighting unit.

British Electrical Repairs, Ltd., 218, Witton Lane, Birmingham, 6.—A booklet describing the company's repair service.

Van der Heem, N.V., The Hague, Holland.—Lists relating to "VDH" motor units.

A. C. Cossor, Ltd., Highbury Grove, London, N.5.—A leaflet describing a new double beam oscillograph.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A 48-page illustrated catalogue of exhaust fans.

Herbert Morris, Ltd., Loughborough.—A 24-page catalogue of petrol- or Diesel-electric cranes.

Marconi's Wireless Telegraph Co., Ltd., Electra House, Victoria Embankment, London, W.C.2.—A booklet (No. 1308) describing short-wave telegraph-telephone receivers.

W. T. Henley's Telegraph Works Co., Ltd., Holborn, Viaduct, London, E.C.1.—A small booklet giving details of plyboards.

Bill Switchgear, Ltd., Aston Lane, Perry Barr, Birmingham, 20.—A catalogue of new "Bill" single-pole and neutral switch and distribution gear.

Castelco (Great Britain), Ltd., 91-93, Southwark Street, London, S.E.1.—Lists describing bakelite accessories, a hairdryer and a heating pad.

Normand Electrical Co., Ltd., North Street, Clapham Common, London, S.W.4.—A catalogue of variable-speed motors giving full technical details.

Scott Insulated Wire Co., Ltd., Queensland Works, Queensbury, London, N.W.9.—A leaflet advertising insulated wires.

Arthur Grey, Ltd., 150, Charing Cross Road, London, W.C.2.—Particulars of "Mello-Chime" door chimes.

Milliwatt Heating Pad, Ltd., 32/6, Fleet Lane, Old Bailey, London, E.C.4.—Details of a battery-operated heating pad.

Gent & Co., Ltd., Faraday Works, Leicester.—A catalogue of "Tangent" fire alarm apparatus.

Thames Wire & Cable Co., Ltd., Bath Hall Works, Bell Lane, Hoddesdon, Herts.—A complete price-list of cotton- and paper-covered high-conductivity copper and wire strips.

Bankruptcy Proceedings

E. P. Hallybone, 15, Kneesworth Street, Royston, Herts, radio dealer and electrical engineer.—This debtor's public examination took place at the Guildhall, Cambridge, on May 19th. His statement of affairs disclosed ranking liabilities of £186 and net assets of £90, leaving a deficiency of £96. Debtor stated that he lost a number of orders for radio sets owing to the international crisis. The examination was adjourned.

C. H. Parsons, 38, East Reach, Taunton, wireless dealer.—The public examination was held on May 19th at the Committee Room, Municipal Buildings, Taunton, and according to the statement of affairs returned there was a deficiency of £80. Debtor said his present position was due to the depression in the radio business during the winter of 1938, want of free capital, and loss through defaulters under hire-purchase agreements. The examination was closed.

E. M. Jones, 26, Eastgate, Aberystwyth, electrical engineer.—The public examination was held at the Town Hall, Aberystwyth, recently. The statement of affairs showed liabilities of £573 and assets of £296. Debtor attributed his failure to lack of capital, bad trade, and keen competition. The examination was closed.

A. Auston, lately carrying on business as Alfred Austen & Sons, electrical contractor and radio dealer, 109, Headstone Road, Harrow, Middlesex.—The public examination of this debtor was held on May 17th at the London Bankruptcy Court before Mr. Registrar Kean. Debtor's statement of affairs showed ranking liabilities of £940 and no available assets. Debtor attributed his failure to competition, decline in trade and bad debts. The examination was concluded.

S. Herzberg, electrical dealer, 11, Victoria Dock Road, Canning Town, E.—This debtor attended at the London Bankruptcy Court for his adjourned public examination before Mr. Registrar Kean on May 18th. He failed in November, 1938, with liabilities of £2,581 and assets of £1,505. The previous hearing was adjourned on February 16th last and the debtor ordered to file a cash and goods account from December 1st, 1937, to November 22nd, 1938. He had filed the account and after he had been briefly questioned upon it by the trustee, the examination was concluded.

C. Richmond, 7, Royd Crescent, Clay Pits Lane, Halifax, formerly trading as C. Richmond & Son, 73, Hanson Lane, Halifax, and 17a, Acorn Street, Halifax, electrical and radio engineer.—The public examination was closed recently at the County Court, Halifax. Debtor, who had liabilities of £865 and a deficiency of £810, attributed his position to lack of capital, bad debts in respect of radio sets sold on hire purchase, and withdrawals in excess of profits.

J. N. Hogg, 104, Allerton Road, and also 16, Woolton Street, Woolton, both Liverpool, electrical engineer.—When the public examination herein was held at the Court House, Victoria Street, Liverpool, on May 16th, it was disclosed that there were liabilities of £4,754 and assets of £414. Debtor attributed his failure to under-estimating, excessive overhead expenses, and retention of unnecessary employees. The examination was closed.

J. Bott, radio dealer, 276a, Alfred Street Central, Nottingham, and lately carrying on business at 41, Wilford Road, Nottingham.—Public examination June 1st at the County Court House, Nottingham.

J. Webster, electrical and radio dealer, 65, Moss Lane, Orrell Park, and 231, Warbreck Moor, Aintree, Liverpool.—Discharge suspended for two years and six months until October 21st, 1941.

D. E. Chaplin and **H. J. W. Taylor** (F. B. Chaplin), electrical contractors and wireless dealers, 95, Oxford Street, Bilston.—First and final dividend of 1s. 3¾d. in the £, payable May 23rd at 37, Temple Street, Birmingham.

H. F. Pitman (Elect Radio Service), radio dealer, 1, Pine Parade, Wallisdown, Bournemouth.—First and final dividend of 5s. 4d. in the £, payable May 24th, at 10, Rockstone Place, Southampton.

R. G. Littlewood (Littlewoods), radio specialist, 19, Burnt Ash Road, Lee Green, S.E.—Application for discharge to be heard on June 7th at the Court House, Greenwich.

E. B. Glendinnen, wireless dealer, 111, Wolverhampton Road, Stafford.—Last day for receiving proofs for dividend June 2nd. Trustee, Mr. S. Shemmell, 16, Darlington Street, Wolverhampton.

F. Arrowsmith, radio dealer, 34, Great Moor Street, Bolton, and at Bury, Accrington and Blackburn.—First and final dividend of 1s. 8½d. in the £, payable May 31st, at 47, Mosley Street, Manchester.

Company Liquidations

Jamesons Radio, Ltd., Notting Hill Gate, W., and Nelson Street, Greenwich, S.E.10.—A meeting of creditors was held recently when it was reported that the liabilities totalled £675. The net assets were £120, leaving a deficiency, as regarded the creditors, of £555. The deficiency was principally attributed to the writing down of the assets and the loss on the trading during the last twelve months. The shareholders had previously nominated Mr. A. Green, Audrey House, Ely Place, E.C., as liquidator, and the creditors decided to confirm the voluntary liquidation with Mr. Green as liquidator.

Baker's Selhurst Radio, Ltd.—Meetings June 27th at 185-193, High Holborn, London, W.C.1, to receive an account of the winding-up by the liquidator, Mr. C. Latham.

Hotlock, Ltd.—Meeting June 28th at 80-81, Avenue Chambers, Southampton Row, London, W.C.1, to receive an account of the winding-up by the liquidator, Mr. L. C. Stewart.

V. Zeitlin & Sons, Ltd.—Winding up voluntarily. Liquidator, Mr. F. W. Inns, 144, Theobalds Road, London, W.C.1.

Dissolution of Partnership

Arcade Electrical Co., radio dealers, 2, The Arcade, Reading.—Mr. B. G. Isaacs and Rachel Isaacs have dissolved partnership.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

RAPID water heater (present address of makers).
SUPERVAC vacuum cleaner.

Parliamentary News

By Our Special Reporter

Public Utility Finance

IN the House of Commons on May 17th Mr. Daggar asked the President of the Board of Trade if he would state the profits of the companies' and local authorities' gas undertakings in Great Britain for the years 1937 and 1938, and the price paid per ton for coal, and similar particulars with regard to the generation of electricity and the production of coke.

Mr. R. Cross, who replied, said that with regard to gas undertakings, the information for 1938 was not yet available. He would circulate particulars in respect of 1937, but he had no information with regard to the price paid for coal. He would also circulate information regarding electricity undertakings for the year 1937-38; the corresponding figures for the year 1938-39 were not yet available. The amount of coke and breeze produced by gas undertakings in 1937 was 12,514,000 tons.

In the statements circulated the following particulars were given for gas undertakings:—Companies (1937): Total paid-up capital (shares, stock and loans), £149,188,232; receipts £49,267,296; profit £7,798,151. Local authorities (1937-38): Total borrowed £83,960,807; repaid and sinking fund balances £57,851,884; receipts £23,386,319; gross profit £3,813,637; net profit £790,168.

For authorised electricity undertakings the following figures were given:—Company undertakings (1937): Capital expenditure £223,098,040; gross surplus £19,640,620; interest £3,090,888; dividends £7,605,119; depreciation and other appropriations £8,944,613. Public authority undertakings (1937-38): Capital expenditure £330,399,068; gross surplus £23,836,509; interest £6,541,371; sinking fund £10,803,946; balance, other purposes, £6,491,192.

The average cost per ton of coal and coke consumed at generating stations of all authorised undertakings during 1937-38 was 18s. 6d., this figure being inclusive of the costs of handling, preparation and ash disposal. The quantity of coke represents less than 2 per cent. of the total coal tonnage.

Damage by Fencing

On May 18th Mr. Gibson asked the Minister of Agriculture if he was aware that great damage was done every year to the hides of cattle by the use of heavy barbed wire for fencing; if he had considered the elimination of such loss by the substitution of a light wire electrified to a low voltage of about 12 volts; and if he would take the appropriate steps to make the use of such electrified wire obligatory with a view to increasing the quality and value of hides produced in this country.

Sir R. Dorman-Smith said he was aware of the advantages and disadvantages of the use of heavy barbed wire as fencing. It was a matter for individual farmers to decide what type of fencing was most appropriate for their needs, and he was not prepared to take steps to make the use of any particular kind of fencing compulsory.

Telephones and A.R.P.

Mr. O. Lewis asked the Postmaster-General on May 20th whether, where a telephone subscriber was prepared to pay for the cost of telephone wires being laid to an underground air-raid shelter on his land, the Post Office was willing to carry out the work and to make no further charge by way of rental unless and until a telephone instrument was actually installed.

Major Tryon said that there were serious objections to the provision of telephone lines to private air-raid shelters on the basis suggested, as there would be no assurance that the line was in working order, nor could the Post Office guarantee the prompt installation of the telephone instrument after the emergency had arisen.

The "Talking Barometer"

Mr. Day asked the Postmaster-General whether his attention had been called to an additional telephone service installed in New York, entitled the "talking barometer," in which a telephone subscriber could at all times dial for and receive a weather forecast in a similar manner as the time was obtained by dialling "TIM" for the time clock as at present operated in this country and when it was proposed to introduce a similar service in Great Britain.

Major Tryon said he was aware that such a service was being given in New York and the possibility of introducing a similar service in Great Britain was already under investigation.

Television Extension

Mr. Day asked the Postmaster-General whether he could now give particulars of any decision arrived at for the purpose of extending the television service beyond the London area; and what difficulties had been experienced in the solution of these problems.

Major Tryon said there were alternative methods of extending the television service beyond the London area, and their respective merits and costs were being actively investigated by the Television Advisory Committee. He had not yet received a report on the result of these investigations.

ELECTRICITY SUPPLY

Buckhaven Tenants' Petition. Proposed New Power Station at Croydon. Objections to North-West Midlands Scheme. Electric Wash-boilers for West Hartlepool Estate

Aberystwyth.—SUB-STATION.—The Town Council is to erect a sub-station at the Waun.

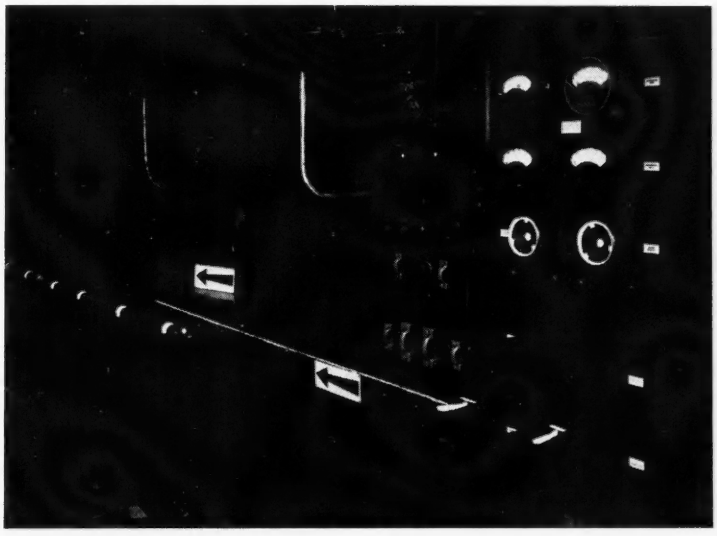
Aylesbury.—SUPPLY TO HOUSING ESTATE.—The necessary wayleaves have been obtained by the Electricity Committee for an overhead line from Manor Park to Buckingham Road, from which point a cable is to be laid underground to a new housing estate. The Committee will eventually provide a supply from a different source by means of underground cables.

Beccles (Suffolk).—STREET LIGHTING.—The Town Council has accepted the tender of the East Anglian Electric Supply Co., Ltd., for street lighting for a period of seven years.

Becontree. — SUB-STATION SITE. — The L.C.C. has leased a site in Pasture Road to the County of London Electric Supply Co., Ltd., for the erection of a sub-station.

Bedford.—MAINS EXTENSION. — The Electricity Committee is to extend the mains at a cost of £502 to supply 46 houses in Spencer Road.

Berkshire. — RURAL SUPPLIES. — Recently a meeting of representatives of local authorities in North Berkshire was held at the Guildhall, Abingdon, to discuss whether steps should be taken to endeavour to obtain a reduction in the charges for electricity. It was decided to send a deputation to meet representatives of Edmundsons Electricity Corporation and the Wessex Electricity Co. in London, to press for a reduction of the rates for both domestic and power purposes so as to encourage the use of electricity for agriculture and rural industries.



An interesting new application of "black" lamps is the illumination of switchboards for A.R.P. The accompanying photograph shows a board with the instruments, labels, etc., treated with phosphorescent powders activated by ultra-violet radiation from G.E.C. "Osira" black-glass lamps

Bexhill.—SUPPLY TO ESTATE.—A sum of £290 is being spent by the Electricity Committee on extending the mains to the Reedley estate.

PROPOSED NEW SUB-STATION.—A site has been purchased by the Committee in Wilton Road for the erection of a sub-station.

Birkenhead.—BROMBOROUGH GENERATING STATION DECISION DEFERRED.—The Town Council last Friday again discussed the Electricity Committee's scheme to erect a large generating station in the Bromborough district at a cost of £1,250,000 without arriving at a decision. After considering the matter in private the Council agreed to appoint a special committee to investigate and report upon the question of a site for the generating station, with authority to negotiate with the Central Electricity Board. When the terms of the resolution were read out by the Town Clerk Alderman Baker asked if the committee had not first to negotiate with the Mersey Docks and Harbour Board, to which the Town Clerk replied in the affirmative. The matter has now been three times before the Council.

Blackburn.—INQUIRY RESULT.—The Ministry of Transport has consented to the Blackburn Corporation placing overhead lines across land owned by Mr. J. T. Walmsley at New Hall Farm, Barker-Brow, Clayton-le-Dale. This question was the subject of a recent inquiry.

Blackpool.—NEW SUB-STATIONS.—The Town Council is acquiring sites on the St. Walburga's Road estate for sub-stations.

Brighton.—EMERGENCY PLANT.—The Waterworks Committee reports that emergency plant to be obtained includes two oil-driven portable electric generating sets, each of 150 kW output.

NEW TURBO-GENERATOR.—The formal inauguration of the second Brush-Ljungström turbo-generator and equipment at the Southwick power station will take place on June 19th.

PROPOSED SUB-STATION.—The Electricity Committee recommends the erection of a new sub-station at Moulsecoombe Way to provide for new works in the area. The estimated cost is £2,702, including high-voltage cable and pilot, and low-voltage distributors.

Buckhaven (Fife).—PETITION FOR ELECTRICITY.—A petition signed by 700 tenants of municipal houses in Buckhaven and Methil, Fife, requesting the installation of electric in place of gas lighting will be brought before next meeting of the Town Council.

Burton-on-Trent. — GENERATING STATION EXTENSION. — The Town Council proposes to extend the generating station at an estimated cost of £681,270.

Caistor.—VILLAGERS PRESS FOR ELECTRICITY.—Representatives of the North Lincolnshire & Howdenshire Electricity Co. who attended a recent meeting of the Rural District Council were informed of the anxiety of the villagers to obtain an electricity supply. Mr. H. F. Riggall, of Limber, said that the feeling of his parish was very strong; 70 per cent. of the people wanted electricity. Mr. S. Kitchinson, of Waddingham, said that his village had been promised electricity two years ago, but to-day they seemed to be no nearer obtaining a supply. Several people had had their houses wired. Mr. I. M. Mackie, for the company, said that the supply would be given but he was not in a position to say when. There were several factors involved. Speaking on the general policy of the company he drew attention to the heavy capital cost of taking supplies to isolated villages. The company had to bear in mind the desirability of keeping the tariffs low and could not have too many unremunerative lines.

Colchester.—SUPPLY IMPROVEMENTS.—The Electricity Committee is to improve the supply in the south-western area at a cost of £1,630.

Croydon.—PROPOSED NEW POWER STATION.—A scheme for the erection of a new generating station at Croydon at a cost of £1,298,300 was approved at Monday's meeting of the Borough Council for submission to the Central Electricity Board. It was explained by Coun. A. L. Boddington, chairman of the Electricity Committee, that this extension to the present station was to be embarked upon on the direction of the Board. In view of the fact that a station of such a size would saddle the undertaking with a burden it could not carry, the Board had agreed to bear all capital charges until 1950. It was anticipated that the Council would then be able to take over the new station and run it on an economic basis. The Board had directed that the new station must be ready to supply electricity to the grid by the autumn of 1942.

HOSPITAL SUPPLY.—At a cost of £1,203 the Committee is to provide an electricity supply to Warlingham hospital.

Falkirk.—ADDITIONAL POWER PLANT.—The Corporation has now received the sanction of the Electricity Commissioners to the installation of additional generating plant. This includes a turbo-alternator set with a maximum continuous rating of 3,000 kW, a boiler unit with an evaporating capacity of 25,000 lb. of steam per hour, and a cooling tower with a capacity of 200,000 gal. per hr. Two old 500-kW turbo-alternator sets are to be removed from the station, the plant in which will now consist of two 3,000-kW sets and one 1,500-kW set, giving a total maximum continuous rating of 7,500 kW as compared with 5,500 kW at present. It is stipulated that the Corporation shall not apply for a further extension of plant for a period of ten years without the concurrence of the Board, and it is to purchase not less than a specified amount of electricity from the Board. The granting of the sanction for the extension marks the end of many years of sustained effort on the part of the Corporation for authority to increase the capacity of the station. When application was first made the Corporation was advised to negotiate for a bulk supply. Following unsuccessful negotiations the Council approached the Central Electricity Board, which made several offers, none of which proved acceptable, the Corporation maintaining that it could generate for itself much more cheaply

than any of the prices quoted for a bulk supply. The Electricity Commissioners then ordered a public inquiry which was held in 1932, and afterwards they refused their consent to the application. Determined not to accept, the Corporation sent a deputation to the Commissioners in London and succeeded in gaining permission to maintain the power station and to generate up to the full capacity of the existing equipment. At the same time the Corporation was instructed to negotiate for a partial supply from authorised undertakers. It was also given power to renew the existing plant when it became necessary to do so.

Fleetwood.—ALTERNATIVE SUPPLY SCHEME DROPPED.—The Corporation is not pursuing a proposal of the electrical engineer (Mr. W. P. Lilwall) for an alternative supply of electricity for Lancaster. The Electricity Commissioners turned down the proposal through technical difficulties which made the scheme impracticable and Fleetwood is now falling in with new proposals to improve the present supply.

Grangemouth.—SUPPLY TO AERODROME.—The Town Council has granted permission to the Scottish Central Electric Power Co. to lay a 6,000-V underground cable to the new aerodrome.

Hertford.—SUB-STATION.—The Northmet Co. proposes to erect a sub-station in Railway Street.

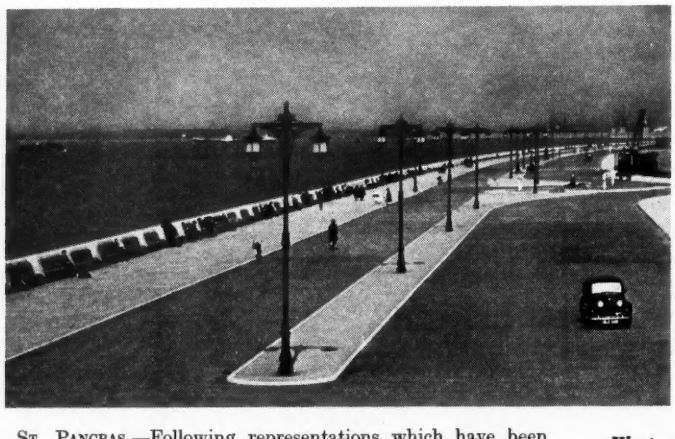
Hertfordshire.—SCHOOL LIGHTING.—The County Council has agreed to the provision of electric lighting at Brunswick Park School, East Barnet, in place of the present gas lighting.

Hayes (Middlesex).—SUB-STATION CONSTRUCTION.—The Uxbridge and District Electricity Supply Co., Ltd., is to erect sub-stations in Yeading Lane and Minterne Way.

Isle of Ely.—SUPPLY TO COLONY.—Following receipt of a report by Mr. H. Booker, consulting electrical engineer, regarding alternative methods of providing an electricity supply at Kingswood Park Colony, the Health Committee recommends that the whole of the supply shall be taken from the Beds., Cambs. & Hunts. Electricity Co.

Lancashire.—INSTITUTION PLANT EXTENSIONS.—The County Council has approved a proposal to provide generating plant at the Ashton Institution. Alderman H. Hyde, who opposed, said he had previously pointed out that Ashton Corporation's price for the supply of electricity was 1.126d. per kWh, against the revised estimate of the county consultant of 1.093d. That amount, on the current estimate for the year, would be £23 per annum less than the Ashton quotation. The figure, however, did not take into consideration the extra cost of labour which was an unknown quantity. Alderman Hyde intimated that Ashton Corporation would oppose the application for borrowing powers when it became the subject of a Ministry of Health inquiry.

London.—ISLINGTON.—Among works in connection with air raid precautions recently authorised is the purchase by the Electricity Committee of spare plant costing £12,500. It is also proposed to spend £1,664 on installing electric lighting in trenches.



ST. PANCRAS.—Following representations which have been made on behalf of a large consumer the Electricity Committee has had before it a report from the chief electrical engineer and manager on the matter and has authorised certain concessions for this class of supply.

HAMMERSMITH.—In order to provide a three-phase electricity supply to additional premises of Johnson, Matthey & Co., Ltd., a low-voltage cable is to be laid and at the same time it is proposed to enlarge the existing sub-station, replace the switchgear and make provision for the installation of a further transformer. The total cost will be £791.

In September last the Council agreed to A.R.P. works at the generating station at a total cost of £2,000. However, under the Civil Defence Bill additional obligations are imposed, and a revised scheme has been prepared under which the cost is increased to £6,358. The scheme includes the protection of plant at the power station and sub-stations and the provision of spare cables, plant and equipment.

Margate.—ELECTRIC LIGHTING.—The Town Council has accepted the tender of the Isle of Thanet Electric Supply Co., Ltd., for lighting Beresford Gardens and St. Mary's Avenue.

Marloes (Pembrokeshire).—SUPPLY NEGOTIATIONS.—Efforts are being made by the Parish Council to obtain a supply of electricity in the area. The County Council has the matter in hand and is approaching the West Cambrian Power Co. to ascertain whether it proposes to provide the supply. Meanwhile the Parish Council has communicated with the Milford Haven U.D.C. Electricity Committee which is willing to give favourable consideration to an application to extend its supply to the area.

North-West Midlands.—OPPOSITION TO POWER STATION SCHEME.—At a public meeting held last week in the Barlaston Parish Hall a resolution was unanimously passed recording a strong protest "against the creation in Barlaston of a generating station which all are satisfied will not only ruin the district as a residential area and a holiday resort for the inhabitants of the Potteries, but will go a long way towards destroying the value of the property in the vicinity." Mr. C. E. Bullock, who presided, mentioned that in response to representations by the Stone Rural District Council the Electricity Commissioners had postponed the proposed public inquiry from May 31st to June 6th. He estimated that opposition to the scheme would cost them not less than £700.—At a meeting of the Stafford, Wolverhampton and Dudley Joint Board for Tuberculosis on Saturday, it was announced that the Board had lodged an objection to the scheme as the station would be only 1½ miles from the Groundslow Sanatorium.—Writing in the *Evening Sentinel*, Mr. J. H. Jervis, of Halmerend, suggests that the station should be built at Halmerend, where there are almost 100 acres of derelict land, with two collieries nearby to transport coal at a minimum cost, and an ample water supply.

Norwich.—HIGH-VOLTAGE LINES.—Increased demand has resulted in a scheme being prepared by the city electrical engineer for the conversion of the Thorpe to Salle and North Walsham lines to 33,000 V at a cost of £32,000. Application is being made to the Electricity Commissioners for sanction to borrow £128,230 to meet the cost of this conversion and for purchasing apparatus to let out on hire.

Spalding.—FLOODLIGHTING OF TULIP FIELDS.—Referring to the photograph of the floodlighted tulip fields at Spalding which we published last week, Mr. F. R. C. Roberts has written to say that the floodlighting has now been discontinued for the season. This year five acres were illuminated by eight 1,000-W floodlights of the beam type on six poles twenty yards apart and 16 ft. high. In between these poles were four 500-W wide-angle floodlamps at 5 ft. from the ground, concentrating particularly on the two shades of pink and the red blossoms. Next year Mr. Roberts hopes to make a more elaborate show in a 40-acre field on the same farm.

Swinton.—EMERGENCY MEASURES.—The Electricity Department has approved expenditure on A.R.P., including an estimate of £10,800 for giving an alternative bulk supply and for providing an interconnection with the existing supply system.

Taunton.—SUPPLY EXTENSIONS.—The Town Council has decided to proceed with an extension of the supply to the villages of Henlade and Thornfalcon at an estimated cost of £750, subject to prospective consumers making a total contribution of £500.

Upton.—IMPROVED STREET LIGHTING.—Last week the Parish Council agreed to an offer by the S.W. & S. Electric Power Co. to improve the street lighting by providing new fittings subject to the Council giving the company a three years' contract for street lighting.

Wallasey's new promenade showing the lighting equipment

Wallasey.—PROMENADE LIGHTING.—Last Saturday the promenade extension to Harrison Drive was opened. It is almost a mile in length and has cost a million pounds. Cast lighting standards of a special decorative pattern and modern double-arm brackets with "Leicester" lanterns were supplied by the Revo Electric Co., Ltd., and 500-W gas-filled lamps are used.

West Hartlepool.—ELECTRIC WASH-BOILERS.—The Town Council is to install electric wash-boilers in 182 houses to be erected on the Dyke House estate.

Peat-fuelled Power Station

OUR Dublin Correspondent reports that the Eire Electricity Supply Board is making arrangements for the erection of a new generating station utilising peat as fuel at Portarlington, near the Clonast Bog. This interesting development is the result of a desire in many circles, particularly those connected with the Government, for the greater use of the almost unlimited peat resources of the country. It is intended to use the peat harvested from the Clonast Bog by the Turf Development Board. The station is designed for a capacity of 20,000 kW. The Board has invited tenders for the boiler plant, generating equipment and other material in connection with the work.

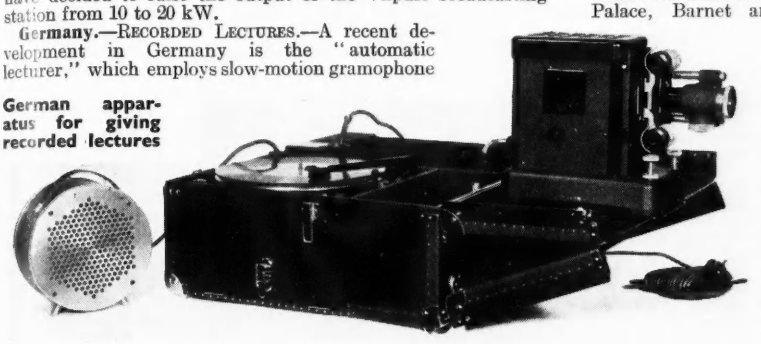
COMMUNICATIONS

Finland.—OLYMPIC GAMES BROADCASTING ARRANGEMENTS.—The Olympic Games Committee of Finland recently commenced preparations for the world-wide radiation of running commentaries of next year's events at Helsinki. A special Radio Bureau has been formed to deal with all technical arrangements. The Olympic Games Committee has ordered equipment for a 100-kW short-wave broadcasting station to be erected at Bjorneborg and it is also understood that German television apparatus will be installed in the principal sports arenas, enabling the transmissions to be picked up in Helsinki and projected on cinema screens. The television equipment will be removed when the Games are over.

LITTLE DEMAND FOR RADIO RELAYS.—A report published recently by the Post Office states that there is practically no demand for radio relay facilities in Finland. The total number of subscribers to relays over the telephone system is only 970. The number of ordinary listeners is just over 316,600.

TRANSMITTER POWER INCREASE.—In addition to previously reported power increases, the Finnish broadcasting authorities have decided to raise the output of the Viipuri broadcasting station from 10 to 20 kW.

Germany.—RECORDED LECTURES.—A recent development in Germany is the "automatic lecturer," which employs slow-motion gramophone records running for 15 minutes each. The set is complete with a projector which can be synchronised with the records so that the slides are changed at the correct moment.



German apparatus for giving recorded lectures

Greenland.—COMMERCIAL RADIO.—The Danish Colonial Office has issued a report stating that radio communication facilities in Greenland have undergone considerable expansion during the past year. There are now 23 transmitters, which handled over 17,000 messages last year.

Lithuania.—CHEAP STANDARD RADIO RECEIVERS.—The number of registered broadcast listeners at April 1st was approximately 55,000, whereas the neighbouring state of Estonia, with less than half as many inhabitants, has over 73,000 listeners. In order to extend radio reception the Lithuanian Government is sponsoring the construction and manufacture of a cheap standard receiver and subsidies have been granted for the erection and operation of public accumulator charging plants all over the country. A new transmitter of 12 kW is being erected, and the power of the Kaunas station is being raised to 120 kW.

TRACTION

Belgium.—RAILWAY ELECTRIFICATION.—The report of the National Railways states that electric trains were operated last year on the line between Brussels and Antwerp. A State Commission has reported in favour of the electrification of the large "star" around Brussels, comprising 450 kilometres of line. The cost is estimated at 1,200 million fr.

Blackburn.—PROPOSED JOINT BOARD.—The report of the two experts, Mr. A. Collins and Mr. A. R. Fearnley, on the question of a joint transport board for Blackburn, Darwen and Accrington similar to the one successfully functioning at Burnley, Nelson, and Colne, has been before the Blackburn Corporation, which has suggested that the report should be discussed jointly by the committees of the three Borough Councils.

Brighton.—NEW TROLLEY-BUS SERVICES.—The formal inauguration of the new Brighton trolley-bus services will take place on Thursday next, June 1st.

Germany.—FURTHER RAILWAY ELECTRIFICATION.—The conversion to electric traction has just taken place of the line between Nürnburg and Saalfeld in connection with the extension of the Nürnburg—Halle—Leipzig scheme. The whole of this extension is to be finished next year.

Great Western Railway.—DECISION AGAINST ELECTRIFICATION.—Early last year the G.W.R. engaged Messrs. Merz and McLellan to investigate the economic advantages of electrifying the main line between Taunton and Penzance, with branch lines. The consulting engineers have recently submitted their report, and according to the *Railway Gazette*, after considering the results of the investigations, the board of directors has decided not to proceed with the project. The conclusions of the consulting engineers were that this section of line was not particularly suited to electrification by reason of its physical characteristics, the nature of the traffic and the wide variation between winter and summer traffic density, while the high cost of electric locomotives was another adverse factor. Altogether, 232 route-miles and 583 track-miles were involved, and the net capital cost of electrification would be more than £4,000,000. About 164 electric locomotives would be required, which, for various reasons, would replace only about the same number of steam locomotives. The severe gradients and curves necessitated unusually high engine power and limited the speed, so that it would be impossible to provide spectacular speeding-up by electrification. About two-thirds of the train mileage over the main-line section was passenger and one-third freight. The peaks in the traffic would involve a high expenditure on fixed equipment and locomotives. The consultants were satisfied that the overhead system would be preferable, and based their estimates on a voltage of 3,000. Owing to the high proportion of curved to straight track, shorter spans than normal would be required between the structures carrying the overhead wires on 61 per cent. of the route in order to maintain the conductors over the middle of the track. This would involve additional cost, while the installation of the overhead conductors would also require fairly heavy expenditure. The saving in working costs would be less than 1 per cent.

London.—NORTHERN ELECTRIFICATION.—Before Underground trains can run from the West End and the City to Alexandra Palace, Barnet and Edgware, over what are now the L.N.E.R.'s steam lines, the London Passenger Transport Board must install a new system of electric signalling, point control and telephone communication. This work is now proceeding rapidly in preparation for the opening of the first part of the extension, to East Finchley, in July. All the existing semaphore signals will be replaced by automatic colour light signals. About 400 ft. in front of each signal will be a fog repeater signal, as well as repeater signals on bends. The four central signal cabins for the extension will be at Park Junction, East Finchley, Finchley Central and High Barnet. Each cabin will have an illuminated diagram from which the signalman will be able to see the position of each train on each section of the track.

EMERGENCY TRANSPORT ARRANGEMENTS IN WESTMINSTER.—In view of the fact that in time of war its vehicles would have to be available for duty for 24 hours each day and that difficulties might be experienced in obtaining supplies the Westminster Council proposes to accumulate additional stocks of electric vehicle batteries, rectifying valves and spare parts for use with the Council's mechanical vehicles. The Highways Committee recommend the purchase of 19 electric vehicle batteries, approximate requirements of spare parts for mechanical vehicles for nine months and three rectifying valves at a cost of £5,250.

Loan Sanctions Issued

DURING the four weeks ended May 20th the Electricity Commissioners sanctioned the borrowing by public authorities (joint electricity authorities, joint electricity boards and local authorities) for electricity supply purposes of a total sum of £1,921,822, made up as follows:—Purchase of property, £7,176; generating station buildings, £98,657; buildings for distribution purposes, £23,574; generating station plant, £394,754; distribution plant, £224,849; mains extensions, houses services, meters and instrument, £588,821; consumers' wiring installations, consumers' electrical apparatus and other purposes, £583,991. The largest sanction was for an amount of £436,556 issued to the Ayrshire Electricity Board in respect of the extension of the Kilmarnock generating station.

The total amount sanctioned during the period April 1st to May 20th was £2,254,148, which compares with £2,605,085 for the corresponding period of last year.

I.E.E. Western Centre

THIS year's annual meeting of the I.E.E. Western Centre was held at St. Austell, Cornwall, from May 12th to 15th, and was attended by over 100 members and guests, including the President, Dr. A. P. M. Fleming, and the Centre chairman, Mr. Harry Ellis. After an informal dinner on the opening day, the annual general meeting of the Centre was held, when officers and committee for next session were elected. Apart from this, however, the social aspect predominated and the dinner was followed by a dance. On Saturday morning visits were paid to Mevagissey and Fowey, and in the afternoon to the Cornish Riviera sports club, where a tea-dance provided an alternative to swimming, tennis, squash rackets and other games.

On Friday evening a sherry party given by the St. Austell & District Electric Lighting & Power Co. preceded the annual dinner, at which the President and the Chairman spoke of the work of the Institution and of the Centre, after which there was dancing until midnight. Sunday afternoon was occupied by a golf competition for the past-chairman's cup, and in a putting tourney. After dinner entertainment was provided by a Cornish musical party and turns by members. During the evening it was announced that a substantial amount had been subscribed to the Benevolent Fund.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Sterdy Telephones, Ltd.—Private company. Registered May 17th. Capital, £1,000. Objects: To acquire the business of an electrical engineer and manufacturer, installer, repairer, maintainer, seller and hirer of telephonic and other electrical apparatus and equipment, indicators, electric locks, clocks, bells, buzzers, relays, transformers and batteries, carried on by W. C. Davey at 176, Tottenham Court Road, W., and elsewhere as W. C. Davey & Co. W. C. Davey, The Croft, Chingford Green, Essex, is permanent governing director and chairman. Solicitors: Godden Holme & Ward, 34, Old Jewry, E.C.2.

W. A. D. Lawrence, Ltd.—Private company. Registered May 17th. Capital, £2,000. Objects: To carry on the business of engineers and manufacturers of machinery, plant, tools, equipment and apparatus for the generation and utilisation of motive power, &c. The first and permanent directors are W. Lawrence, "Hillmorton," Milngavie, Glasgow, and A. Lawrence. Solicitor: David Macmillan, Glasgow.

W. S. Westin, Ltd.—Private company. Registered May 11th. Capital, £2,000. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in dynamos, motors, magnetos, batteries, rubber, insulating materials, radio receiving apparatus and accessories, &c. The permanent directors are: W. S. Westin and Mrs. F. C. Westin, both of 46, Thornhill Avenue, Lindley, Huddersfield. Registered office: Colne Road, Huddersfield.

Stook & Banwell, Ltd.—Private company. Registered May 15th. Capital, £500. Objects: To carry on the business of manufacturers of radio, television, gramophone and sound reproducing machines, &c. The directors are: H. O. Banwell, 21, Gloucester Road, Hampton, Mdx.; and G. R. Stook, 23, Mayfair Avenue, Worcester Park. Registered office: 53, Doughty Street, John Street, W.C.1.

Via-Duct Heating and Ventilating Co., Ltd.—Private company. Registered May 18th. Capital, £1,500. Objects: To carry on business as heating, ventilating and fire protection experts and advisers, manufacturers of and dealers in heating, ventilating and temperature control plant, gas, electric, coal and oil burning apparatus and fittings, &c. The directors are: R. J. Faulkner, 28, Mount Ephraim Road, S.W.16, and two others.

King's Cross Battery & Ignition Co., Ltd.—Private company. Registered May 18th. Capital, £1,000. Objects: To carry on the business of general and electrical engineers and contractors, battery manufacturers, &c. The directors are: H. N. Ridgway, 178, Pentonville Road, King's Cross; and Mrs. D. C. MacCarthy, 358, Nelson Road, Whitton, Middlesex. Solicitor: R. J. Mawson Howe, Copthall House, Copthall Avenue, E.C.2.

Link Manufacturing Co., Ltd.—Private company. Registered May 20th. Capital, £1,000. Objects: To carry on the business of manufacturers and factors of and wholesale and retail distributors of household and other appliances of a mechanical or electrical nature, advertising contractors and agents, &c. The permanent directors are: F. Tayler, Woodlands, Meads Road, Eastbourne, and two others. Solicitors: Chas. Howard & Co., Manchester.

West & Selman, Ltd.—Private company. Registered May 20th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical hairdressing appliances, dynamos, motors, armatures, magnetos, batteries, &c. The directors are: G. T. W. West, 602, Old Kent Road, S.E.15, and J. Selman, 22, Kennington Road, S.E.1. Secretary: A. Coombes. Registered office: 602, Old Kent Road, S.E.15.

Richard Nundy & Co., Ltd.—Private company. Registered May 20th. Capital, £3,000. Objects: To carry on the business of welders and general engineering manufacturers, electrical, wireless, aircraft and general engineers, agents for and dealers in electrical apparatus, &c. The permanent directors are: R. W. Nundy, 67, Bath Road, Wolverhampton (chairman), and J. F. Crerar, 82, Packington Street, Islington, N.1. Solicitors: Underhill & Co., 7, Waterloo Road, Wolverhampton.

C. L. Jones, Ltd.—Private company. Registered May 20th. Capital, £15,000. Objects: To carry on the business of welders of metals of all kinds by electricity, oxy-acetylene or other processes, constructional, mechanical and electrical engineers, &c. The directors are: E. H. Jones, Aldenham Grange, Letchmore, Herts, and S. Williams, 22, Park Avenue, Harrow Weald. Solicitors: W. R. J. Hickman & Randall, 3, South Place, E.C.2.

Returns of Electrical Companies

Statements of Capital

Hendon Electric Supply Co., Ltd.—Capital, £600,000 in 200,000 preference and 400,000 ordinary shares of £1. Return dated March 28th, 1939. All shares taken up. £347,113 paid on 200,000 preference and 147,113 ordinary shares. £252,887 considered as paid on 252,887 ordinary shares. Mortgages and charges, £172,140.

T. W. Broadbent, Ltd.—Capital, £5,000 in 440 5 per cent. preference and 560 ordinary shares of £5. Return dated February 28th. All shares taken up. £35 paid on 7 ordinary shares. £4,965 considered as paid on the remainder. Mortgages and charges, nil.

City of Buenos Ayres Tramway Co. (1904), Ltd.—Capital, £1,240,000 in £5 shares. Return dated March 1st. All shares taken up. £1,240,000 considered as paid. Mortgages and charges, £102,219.

Chapei Tramway Co., Ltd.—Capital, £12,040 in £1 shares. Return dated March 22nd. All shares taken up. £12,040 paid. Mortgages and charges, nil.

Electric & Radio Supply, Ltd.—Capital, £100 in £1 shares. Return dated July 25th, 1938 (filed April 14th, 1939). 14 shares taken up. £14 paid. Mortgages and charges, £600 debentures.

South African Electrical Imports

IMPORTS of electrical machinery into the Union of South Africa in 1938 again increased, after large advances in preceding years. Those of other electrical apparatus were well maintained, with the exception of cable and wire, in which case there was a decline of about 20 per cent. in value. This drop may be attributed partly to heavy imports in former years and partly to the activities of the new cable works at Vereeniging. Noteworthy increases were: Transformers, approximately 50 per cent.; and "other electrical materials, appliances, &c., 25 per cent.

The following figures giving the values of the leading groups and supplying countries last year are taken from the recently issued annual statement of the foreign trade of the Union. It will be seen that the share of the United Kingdom was well maintained in a market in which a number of other European countries as well as Canada are competing.

	1938 £ (000)	Inc. or dec. on 1937 £ (000)
Cable and wire—		
Total	961	− 295
From United Kingdom	776	− 314
,, Belgium	29	− 15
,, Germany	118	+ 39
,, United States	12	—
Heating and cooking apparatus—		
Total	329	− 54
From United Kingdom	93	− 15
,, Canada	141	− 45
,, Germany	24	− 1
,, United States	61	+ 13
Meters—		
Total	52	− 10
From United Kingdom	47	− 4
,, Germany	4	− 3
Vacuum cleaners and floor polishers—		
Total	104	− 3
From United Kingdom	23	+ 5
,, Germany	41	− 8
,, Sweden	24	− 2
Electric hand-lamps—		
Total	25	+ 1
From United Kingdom	2	− 1
,, Hongkong	10	+ 4
,, United States	11	—
Electric lamp bulbs—		
Total	203	− 16
From United Kingdom	141	− 4
,, Germany	13	+ 2
,, Hungary	11	—
Self-contained elec. lighting outfits—		
Total	39	− 22
From United Kingdom	16	+ 1
,, United States	21	− 21
Radio apparatus and accessories—		
Total	730	− 47
From United Kingdom	132	+ 44
,, Germany	17	+ 6
,, Holland	158	+ 37
,, United States	415	− 136
Radio telegraph and telephone instruments and appliances—		
Total	33	+ 20
From United Kingdom	28	+ 18
,, Germany	4	+ 3
Telegraph and telephone material and instruments—		
Total	83	+ 7
From United Kingdom	57	+ 2
,, Germany	13	+ 2
,, Sweden	8	+ 3
,, United States	4	—
Porcelain insulators—		
Total	53	− 10
From United Kingdom	17	− 3
,, Canada	27	− 8
Batteries, primary—		
Total	82	− 72
From United Kingdom	28	− 5
,, United States	50	− 65
Batteries, secondary—		
Total	173	+ 18
From United Kingdom	54	+ 9
,, Germany	13	+ 4
,, United States	101	+ 3
Dynamos and generators—		
Total	142	+ 10
From United Kingdom	118	+ 23
,, United States	13	− 10
Motors—		
Total	569	+ 13
From United Kingdom	401	− 29
,, Germany	25	—
,, Sweden	49	− 7
,, United States	75	+ 3
Transformers—		
Total	513	+ 167
From United Kingdom	377	+ 148
,, Germany	75	+ 35
,, Sweden	11	—
,, United States	39	+ 1
Other elec. materials, appliances and fittings—		
Total	2,554	+ 490
From United Kingdom	1,965	+ 444
,, Canada	15	− 7
,, Germany	167	− 36
,, Holland	14	− 3
,, Sweden	15	− 1
,, Switzerland	37	+ 29
,, United States	312	− 67

Banbury & District Electric Supply Co., Ltd.—Capital, £75,000 in £10 shares. Return dated April 20th, 1939. All shares taken up. £50,000 paid. £25,000 considered as paid. Mortgages and charges, nil.

British Insulated Cables (S.A.), Ltd.—Capital, £2,000 in £1 shares. Return dated March 8th, 1939. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Mortgages and Charges

Madison Appliances, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated May 5th, 1939, to secure £2,500. Holders: Brunwec, Ltd.. 28, Cumberland Street, St. Pauls, Bristol.

Morphy-Richards, Ltd.—Charge on freehold hereditaments on Arterial Road, St. Mary Cray, Kent, dated May 12th, 1939, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £4,000.

Receivers Appointed

Bowlings Electric Supply, Ltd.—E. J. C. Swaysland, 601/602, Grand Buildings, Trafalgar Square, W.C.2, was appointed receiver and manager on May 2nd, 1939, under powers contained in debenture dated November 12th, 1937, and further charge dated February 10th, 1938.

Increases of Capital

Wireohms, Ltd.—The nominal capital has been increased by the addition of £4,400 beyond the registered capital of £2,000. The additional capital is divided into 400 ordinary and 4,000 6 per cent. cumulative preference shares of £1.

Gent & Co., Ltd.—The nominal capital has been increased by the addition of £20,000, in £1 shares, beyond the registered capital of £50,000.

Reports and Dividends

Siemens Bros. & Co., Ltd., held their annual meeting on May 19th, when Lord Queenborough (chairman), who presided, said that during the year under review they had further extended their buildings and plant, involving an expenditure of £155,000. During the past three years they had spent by way of new buildings and plant, loose tools (since written off) and other assets, well over £400,000.

The Greenwich works of Submarine Cables, Ltd., which they owned jointly with the Telegraph Construction & Maintenance Co., Ltd., continued to be fully occupied, the production last year including two cables of the modern co-axial type for supplementing the telephone service to Eire and the Channel Islands. Contracts were carried out for the supply of telegraph cables to Cable & Wireless, Ltd., the Western Union Telegraph Co., and other leading telegraph administrations, while the French Government entrusted them with the manufacture of the most noteworthy addition made in recent years to the submarine telegraph cable system of the world. In spite of the active competition of new manufacturing concerns, contracts for underground power and lighting cable fell little short of the high level reached in 1937. The plant worked at practically full capacity throughout the year on substantial orders for super-pressure and high-voltage mains.

The plant for the production of underground telephone cable had been working to full capacity on Post Office and other Government Department contracts, and as the new workshop came into full production the total output of telephone cable, measured by mileage, was substantially greater than that of any previous year. The main trunk telephone routes were now being developed with a standardised type of high-frequency cable in which each pair of wires transmitted at least twelve simultaneous conversations. The section between London and Oxford, completed by them in 1937, was extended last year as far as Gloucester, and was now being carried further westward. The first cable of this advanced type for service in Australia was now being manufactured at Woolwich and would constitute the main underground Sydney-Maitland telephone trunk route.

The manufacture of a record number of automatic public telephone exchange equipments had kept their telephone shops fully occupied. The Post Office had entrusted them with contracts for seventy-seven equipments, comprising both new exchanges and extensions of existing exchanges. During the period under review they had successfully put into operation fifty-one such equipments. They had also brought into service during 1938 forty-eight rural exchanges. In connection with the telephone trunk system they had brought into service a number of systems of carrier equipment. The development of carrier-current operation had brought about a demand for improved signalling facilities. These were being provided by the extensive use of currents of voice frequency which could be transmitted over the same paths as the speech currents themselves. A considerable amount of equipment was involved and they had been entrusted with the execution of several important contracts, including the conversion of Birmingham and Leeds trunk exchanges to the use of such equipments.

They had received orders for new exchanges as well as extensions of existing exchanges in Australia, South Africa, Rhodesia, India, Chile, Malta and Guernsey. The automatic trunk exchange which they were manufacturing for the Australian Post Office to handle long-distance traffic in the State of Victoria was progressing satisfactorily. This equipment had entailed a considerable amount of development work, and represented a striking advance on anything hitherto undertaken in automatic trunk switching.

Both their sales and rental business dealing with private telephone systems continued to show a steady expansion. There had been a steady demand for electric totalisator apparatus, but this business was not being so actively pursued at present owing to urgent Government contracts of national importance. Orders for marine wireless equipment, marine signalling apparatus and torsion meters all showed a further increase over the previous year. Overseas orders for their products showed a further expansion over the preceding year, the business being almost exclusively confined to the Empire.

Their subsidiary company, Siemens Electric Lamps and Supplies, had again had a successful year. The sales of Siemens lamps for general lighting continued to grow and substantial orders had been received for special types of lamps, such as low-voltage tungsten lamps for use on aircraft and special lamps for aerodromes. The sales of rubber wires were well maintained. The additional new lines of Siemens domestic appliances referred to last year had resulted in an increased turnover. The very large amount of work in hand at the beginning of the year and the orders received so far would, if maintained, keep the works fully occupied during the current year. With regard to the recent strike at their works, there was no truth in the allegation that the management of the company was antagonistic to trade unionism; this was proved by the decisions of the trade unions in this matter.

The Telephone Manufacturing Co., Ltd.—Presiding at the annual meeting held on May 22nd, Mr. F. T. Jackson (chairman and managing director) said that the past year had been one of great development, particularly during the last few months of the year, which would have an important bearing on the future profit-earning capacity of the company. It had been necessary to change over the output of the factory from the mass production of telephone apparatus to armament work. Intensive research and development work had been carried out with a view to placing the company in the front rank of their industry. The importance of this work had been recognised by a large company in their own line of business, as a result of which they had been able to enter into an agreement with this concern for a period of years to distribute throughout the world the whole of the special apparatus manufactured by the company. They had purchased a factory site out of London to cope with the contracts which they anticipated would mature when rearmament was finished.

They had a record order book at the end of the year, and during the first three months of the current year the contracts secured for future delivery were 108 per cent. in advance of the contracts secured in the corresponding period of 1938. It would therefore be appreciated that they could look forward to a prosperous 1939 and 1940 which would not be affected to any extent by intensification of international complications.

It was proposed to increase the authorised capital of the company to £500,000, but no immediate issue would be made. The proposed increase of capital was approved.

The Lancashire Electric Light & Power Co.—Underwriting has been arranged for an issue of 300,000 £1 ordinary shares, which will be offered at 26s. 6d. each in the proportion of one for every 12 ordinary or 7 per cent. cumulative participating preference shares held. The shares will rank for dividend *pari passu* with the existing shares. An issue to liquidate indebtedness to bankers and to provide for current expenditure was foreshadowed by Mr. G. Balfour at the annual meeting on February 23rd.

Telephone Properties, Ltd., reports a revenue for 1938 of £92,493, as compared with £90,229 for the preceding year, and a net profit of £53,108 (against £42,741). Reserve for contingencies receives £10,000, and the ordinary dividend for the year is 6 per cent. (against 5 per cent., plus a bonus of 1 per cent.). The balance carried forward is £35,172 (against £26,674).

The Reason Manufacturing Co. reports a net profit for 1933 of £4,058 (against £3,633). An interim dividend of 1s. per share is paid on the ordinary, and £2,911 is carried forward.

Kalgoorlie Electric Power & Lighting Corporation reports a profit for 1938 of £30,997, as compared with £31,544 in the preceding year, and after deducting income tax, N.D.C., depreciation, &c., there is a net profit of £26,273 (£25,526). The dividend for the year is maintained at 7½ per cent., less tax, and £12,211 is carried forward (against £11,463 brought in).

The Delhi Electric Supply & Traction Co. reports a net revenue for 1938 of £53,077, as compared with £52,689 for 1937, and a net profit of £31,401 (against £23,365). General reserve receives £8,001, and the final dividend is 6 per cent., making 10 per cent., tax free, for the year (against 11 per cent.). The balance carried forward is raised from £17,463 to £20,864. The Delhi Central Electric Power Authority took over the power station of New Delhi Municipality on April 1st, 1939, and the company is receiving from that authority a supply in bulk which meets a large part of its requirements. The company has been called upon to make a considerable reduction in the charges for electricity, and, having regard to the uncertainty of outlook, the board has recommended a reduced final dividend.

The British Vacuum Cleaner & Engineering Co., Ltd., is paying an interim dividend of 5 per cent., less tax. The interim in 1938 was 10 per cent., but was paid on smaller capital.

The Electric Furnace Co., Ltd., has announced a final dividend of 4½ per cent., less tax, making 7 per cent. for the year (against 8 per cent.).

Meters, Ltd., reports a net profit for the year ended March 31st of £25,160, as compared with £23,489 in the preceding year, and an available balance of £32,614. Reserve for N.D.C. receives £2,200 and A.R.P. precautions reserve £5,000. The final ordinary dividend is 6½ per cent., making 9 per cent. for the year, less tax (same), and £13,377 is carried forward (against £13,696 brought in).

Radio Central Exchanges, Ltd., states that certain negotiations are at present in progress in connection with the shares of the company. These negotiations have not been concluded but a further communication is to be made shortly.

The International Telephone & Telegraph Corporation, in a preliminary statement of the consolidated income account, including subsidiaries, for 1938, reports total gross earnings of $67,518,700 as compared with $63,453,870 in 1937, and net earnings of $18,050,383 (against $20,296,865). The total charges of subsidiaries are $4,480,190 and the interest charges of the parent company $6,531,603, leaving a net income of $7,038,590 (against $10,236,148).

Newton Brothers (Derby), Ltd., in a preliminary statement, report a profit for the year ended March 31st of £35,342, as compared with £15,858 for 1937-38. The dividend for the year is maintained at 12½ per cent., and it is also proposed to distribute a capital bonus of 100 per cent.—one share for every one held. This will raise the issued capital from £39,496 in shares of 2s. to £78,992.

Edmundsons Electricity Corporation, Ltd., reports a total income for 1938 of £897,130, as compared with £867,609 in the preceding year, and after providing for taxes, debenture interest, &c., there is a balance available of £583,798. The ordinary dividend for the year is 6 per cent., reserve receives £30,000, and the balance carried forward is raised from £98,184 to £133,161. The dividend for 1937 was 9 per cent., but in that year a share bonus of 50 per cent. was distributed, and the new shares receive the dividend announced for 1938. Meeting: May 31st.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Britannia Switchgear and Electrical Equipment Co., Ltd.; H.O. Electrical Manufacturing Co., Ltd.; Motor Radio, Ltd.

Ransomes, Sims & Jefferies, Ltd., report a net profit for 1938 of £65,270, as compared with £72,412 in the preceding year, and an available balance of £114,644. The ordinary dividend for the year is 7½ per cent., less tax (against 5 per cent.), reserve receives £25,000, and £52,144 is carried forward (against £60,374).

Glenfield & Kennedy, Ltd., report a profit for the year ended March 31st of £104,648, as compared with £78,259 for 1937-38, and an available balance of £118,795. The staff pension fund receives £4,971; dividend equalisation fund £10,000; and tax reserve £20,000. The final ordinary dividend is 5 per cent., less tax, making 10 per cent. for the year (same), plus a bonus of 10 per cent. (against 5 per cent.), and £34,675 is carried forward (against £33,842 brought in). The report states that the works were fully employed during the year and turnover showed a considerable increase in spite of continued keen competition in the home and overseas markets.

Telephone Rentals, Ltd., has declared a final dividend of 6 per cent., less tax, making 10 per cent. for the year (unchanged).

The Electrical Finance & Securities Co., Ltd., is paying a final dividend of 7½ per cent., making 12½ per cent. for the year (same).

Stocks and Shares

TUESDAY EVENING.

THE outstanding feature in the Stock Exchange markets this week is a rise in the price of War Loan. From 91½, the price quoted a month ago, the stock has risen to 94. This set the tone for gilt-edged issues as a whole.

Other markets are quiet, with prices generally firm. The impression grows that fear of war can be relegated to the future. As a consequence, markets are not quite so sensitive as they had been previously to any rumour which might come into circulation. Conditions are as quiet in New York as they are on this side, where business, owing to this week's races and the forthcoming Whitsun holidays, has again been of small volume save in the gilt-edged sections.

In the early part of the week, two excellent events reflected the progress being made by the electrical and by the telephone branches of industry. Edmundson's report shows the company's net profits to be up by £53,700. The Telephone Manufacturing Company held its meeting last Monday. The chairman stated that not only had the end of the financial year concluded with a record number of orders in hand, but that, for the first quarter of the present period, contracts for future delivery had doubled those of the corresponding quarter in 1938.

Cable and Wireless Dividend Prospects

Holders of the Cable and Wireless issues had their stock of information completed at the annual meeting of the holding company. Few gaps had been left by previously published reports of both the operating and holding concerns, and by the former's annual meeting. Further handsome rises in the preference and ordinary stocks suggest, therefore, that attention fixed largely on the latter part of Lord Pender's speech, which dealt with the prospects. Mentioning the rashness of prophecy in these times, the chairman saw no reason, so far as he personally was able to judge, why the 4 per cent. dividend on the ordinary stock should not be repeated next year. Thus encouraged, the price of that stock advanced 3 points to 49½, which brings the yield down to £8 1s. 8d. per cent. The preference stock has moved up to 92½, the present yield of nearly 6 per cent., although still on the generous side, reflecting the recent rise of the security in the investor's estimation. Lord Pender's speech underlined the success of the Empire flat rate scheme. The value of traffics in March, he said, was practically equal to that of March a year ago, when the higher rates were ruling.

Traffics Index Discontinued

On the ground that the monthly cable traffics index gives a misleading impression of the Cable & Wireless company's affairs, the directors have decided to discontinue its publication after June. Throughout 1938 the index painted a much gloomier picture than was presented later by the actual state of affairs in the annual accounts. The sharp recovery in stock prices on the latter's appearance is held to show the attachment of undue importance to the index figures, which relate to only one of the three main sources of revenue. Although recognising that the index is open to a possibility of misconception, it is hoped that some other way will be found for indicating progress from time to time. It is not only the combine's stockholders who have looked to the index for a rough guide to the state of international trade. The latest figure, relating to April, rises well above the corresponding figure for 1938.

Electrical Equipment

Callenders, quoted ex the final dividend of 2s. per share, are a few pence harder at 66s. 3d. At this price the yield is 4½ p.c., on the basis of the 15 p.c. dividend. Electric Constructions have risen 2s. 6d. to 37s. 6d. Siemens are a good market at 23s. 9d. Other shares, whose prices are better, include Associated Electrical, Ericssons and Walsall Conduits. On the other hand, Automatic Telephones are easier at 45s. Telephone Properties at 13s. 9d. have recovered the dividend deduction; the report shows an increase of £2,000 in the dividends and interest received from the subsidiary company.

Square Deal

The appearance of the Transport Advisory Council's report on the railways' "square deal" claim came as something of an anti-climax to the market, for the broad lines of the recommendations had already become apparent during the preliminary talks and negotiations. Judgment of the recommendations is generally agreed that, even if the corners of the square have been distinctly rounded off by the safeguards, valuable ground has been gained, for the companies have carried their main point that statutory control of railway charges should be relaxed. In its place is to be a new structure of rates based on mutual agreement and consultation between the interests involved. Quick expansion in the revenue, on this account alone, is not looked for, even assuming early legislation. On the long view, however, stockholders will probably be pleased with the degree of success achieved by the campaign, and, in the meantime, traffics are good. Both the Southern Railway stocks quoted opposite have gained a point. London Passenger Transport "C" stock is similarly better. The other issues of the Board have advanced in sympathy with gilt-edged securities.

Indian Companies

Madras Electric Supply shares have been disturbed by the reference, in the recent report, to the local Government's demand for a reduction in rates. Shareholders were warned a year ago that pressure was being brought to bear in this direction. Nevertheless the price of the shares has receded to 26s. 3d. ex dividend, on the news, which rubs off some of the gilt from a satisfactory showing in the accounts for 1938. If fully enforced, the company's report says, the cuts would have a serious effect on revenue. Negotiations are in progress. On the present dividend rate of 8 per cent., tax free, the net yield is over 6 per cent.

There was a sting, also, in the tail of the Calcutta Electric Supply Corporation's good report for 1938. More capital is required for completing the development programme, and, according to the chairman, the future will not see profits on quite the same scale as in the most prosperous days. The dividend is maintained at 10 per cent., tax free, but shareholders are warned not to expect more than 9 per cent. next time. Evidently the board is planning well ahead, and none but the shortsighted will quarrel with the policy. The shares remain on the dull side, at 34s. 6d. On a 9 per cent. tax free dividend the net return would be just under 5¼ per cent.

Cawnpore Electric shares at 28s. 3d. afford a little over 7 per cent. on the money; the 10 per cent. dividend is paid less tax. The year's progress, in the face of severe labour and other troubles, is taken as a hopeful portent of the company's prospects under normal working conditions.

Miscellaneous Matters

The gilt-edged market is presenting a brave face to the prospect of heavy Government borrowing, prices of both the dated and undated issues carrying the advance a stage further. Investment shares have not failed to take their cue from the strength of British Government stocks. Scattered improvements in the list of electricity supply shares show that Clyde Valleys, at 36s. 3d., are a particularly good spot in this market.

Among traction issues, British Electric deferred improved from 900 to 950 ex dividend. Bristol Trams rose 1/6 to 45s. Marconi-Marines, with a 2s. rise to 28s. 3d., are a feature of the telegraph and telephone section, in which Globe Telegraph ordinary, with a gain of 1s. 9d. to 30s., and the preference at 25s., show ready response to the activity in Cable and Wireless stocks. Wall Street reflects a doubtful attitude towards events at home and abroad, but American Telephone and Telegraph again rose 2, bringing the price to 174½. Canadian Marconis improved to 4s. 6d. on the royal visit to the Dominion.

The Lancashire Electric is about to offer its shareholders 300,000 new ordinary shares at 26s. 6d. The proportion is to be one new share for 12 old shares. As the current price of the ordinary is 31s. 3d., it seems rather waste of money to have underwritten the new issue.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 High-est	1939 Low-est	Dividend Pre-vious	Dividend Last	Price May 23	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	68/3	63/9	15	15	63/9	—	4 14 4
British Power & Light	30/9	26/–	7	7	28/6	+6d.	4 18 3
City of London	33/9	31/–	7½	7½	32/–	—	4 2 6
Clyde Valley	37/9	34/–	8	8	36/3	+⅛	4 8 2
County of London	46/9	41/9	10½	10½	44/–	+1/–	4 17 8
Edmundson's :							
7% Pref.	31/6	30/–	7	7	31/–	+6d.	4 10 4
Ord.	27/9	23/–	9	6	24/6xd.	+1/–	4 18 0
Elec. Dis. Yorkshire	41/6	37/9	9	9	38/9	—	4 12 9
Elec. Fin. and Securities	47/9	45/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation	51/9	48/–	12	12	47/–	—	5 2 0
Isle of Thanet	20/–	18/6	4	4	18/6	—	4 6 6
Lancs Light and Power	34/6	29/–	7½	7½	31/3	—	4 16 0
Llanelly Elec.	22/6	21/–	5½	5½	21/–	—	5 4 9
Lond. Assoc. Electric	29/3	26/3	7	7	26/3	—	5 6 8
London Electric	34/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	106½	102½	5	5	102½	—	4 17 6
Metropolitan	51/–	45/3	12	12	47/–	+9d.	5 2 0
Midland Counties	38/9	34/–	8	8	37/–	—	4 6 6
Mid. Elec. Power	41/9	38/3	8	9	38/9	—	4 13 0
Newcastle Elec.	28/9	26/6	7	7	27/–	—	5 3 8
North Eastern Electric :							
Ordinary	32/3	28/6	7	7	29/–	+6d.	4 16 7
7% Pref.	32/6	30/-	7	7	31/–	—	4 10 4
Northampton	48/–	45/–	10	10	47/6	—	4 4 2
Notting Hill 6% Pref. (£10)	13½	13	6	6	13	—	4 12 4
North Met. Elec. :							
Ordinary	46/6	41/6	10	10	43/9	+6d.	4 11 4
6% Pref.	29/–	27/6	6	6	27/6	—	4 7 3
Richmond Elec.	29/–	27/3	7	7	27/6	—	5 1 10
Scottish Power	38/9	33/9	8	8	35/–	+9d.	4 11 5
Southern Areas	22/9	19/6	4½	5	20/–	—	5 0 0
South London	30/9	28/–	7	7	28/–	—	5 0 0
West Devon	23/3	22/6	5	5	22/6	—	4 9 0
West Glos.	21/3	18/–	2	2½	18/6	—	2 14 1
Yorkshire Elec.	38/6	34/9	8	8	36/6	—	4 7 8
Overseas Electricity Companies							
Atlas Elec.	4/3	2/–	Nil	Nil	2/9	—	—
Calcutta Elec.	39/–	34/6	10*	10*	34/6	—	—
Cawnpore Elec.	34/6	28/3	10	10	28/3	—	7 1 7
East African Power	26/3	22/6	7	7	24/–	—1/–	5 16 8
Jerusalem Elec.	24/6	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	10/6	9/6	7½	7	10/3xd.	+3d.	7 6 4
Madras	31/–	28/6	8*	8*	26/3xd.	—1/9	5 6 2
Montreal Power	34½	31	1½	1½	33¾	+¾	—
Palestine Elec. "A"	29/6	26/3	7½*	7½*	27/–	—	5 11 1
Perak Hydro-electric	18/9	15/–	7	6	15/–	—	8 0 0
Shawinigan Power	23½	20	85cts.	83cts.	21¼	—¾	—
Tokyo Elec. 6%	61	50	6	6	51½	—	11 13 0
Victoria Falls Power	72/–	60/–	12	13½	67/6	—	4 0 0
Whitehall Investments Pref.	19/6	16/–	7½	7½	17/–	—	8 16 6
Public Boards							
Central Electricity :							
1950–70	112	106	5	5	108¾	+2	4 12 2
1955–75	115¼	108	5	5	109	+¼	4 11 9
1951–73	106¾	103½	4½	4½	105½	—	4 5 4
1963–93	95¼	86	3½	3½	89	—	4 1 5
London Elec. Trans. Gtd.	88½	84	2½	2½	86½	+1	2 17 6
London & Home Counties, 1955–75	107½	106½	4½	4½	107	—	4 4 1
Lond. Passenger Transport :							
A	114½	104¾	4½	4½	106½	+1	4 4 6
B	117½	105	5	5	109¾	+2	4 11 4
C	78¼	64¼	4¼	4	71¼	+1	5 12 0
West Midlands Joint Elec., 1948–68	112½	109	5	5	108¼	−1	4 12 2
Telegraph and Telephone							
American Tel. & Tel.	180	159	9	9	174½	+2	5 3 4
Anglo-Am. Tel. :							
Pref.	101½	89½	6	6	92½	+2	6 9 7
Def.	23⅝	19	1½	1½	20½	+½	7 6 4
Anglo-Portuguese	24/–	19/9	8	8	21/3	—	7 10 7
Cable & Wireless :							
5½% Pref.	90½	75	4½	5½	92½	+2	5 19 0
Ord.	49	34	4	4	49½	+3	8 1 8
Income	100	95½	—	—	97	+1	4 2 6
Canadian Marconi $1	5/3	3/9	—	Nil	4/6	+6d.	—
Globe Tel. & Tel.:							
Ord.	28/3	23/6	5½*	7½*	30/–	+1/9	5 0 0
Pref.	26/9	23/3	6	6	25/–	+⅛	4 16 0
Great Northern Tel. (£10)	38	27½	20	20	33½	—	5 19 4
Inter. Tel. & Tel.	10½	7½	Nil	Nil	7½	−½	—
Marconi-Marine	29/–	23/–	7½	10	28/3	+2/–	7 1 6
Oriental Telephone Ord.	2½	46/3	12*	12*	2⅞	—	4 16 0
Radio Corpn.	8⅞	6	8	6	7	—	—
Telephone Props.	14/–	12/9	5	6	13/9xd.	+1/–	8 14 6
Telephone Rentals (5/–)	10/–	8/6	5	6	9/3	—	3 4 10
Western Union	25¼	19½	2¾	—	20½	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref.	7/6	3/6	Nil	Nil	6/3	—	—
4% Inc.	16	7	Nil	Nil	13	—	—
British Electric Traction :							
Def. Ord.	1000	700	5	5	950xd.	+50	—
Pref. Ord.	164	158	8	8	150xd.	—	5 6 8
Bristol Trams	48/6	37/3	8	10	45/–	+⅛	4 9 0
Brazil Traction	13	7⅞	$1	—	11	—	—
Calcutta Trams	25/6	23/6	8	8	23/–	—	6 19 2
Cape Elec. Trams	18/–	16/9	5	6	17/6	—	6 17 2
Lancs Transport	36/6	32/6	10	10	32/6	—	6 3 1
Mexican Light :							
1st Bonds	25	21	5	5	25	—	—
Rio 5% Bonds	81	47	5	5	70	—	7 2 10
Southern Rly :							
5% Prefd.	71	48	5	5	69½	+1	7 4 0
5% Pref.	97½	80	5	5	93½	+1	5 7 0
T. Tilling	48/–	39/6	10	10	46/3	+1/3	4 6 7
Tilling & B.A.	53/–	50/–	10	9*	52/6	—	3 8 7
West Riding	37/9	31/3	10	10	33/9	—	—
Equipment and Manufacturing							
Aron Electricity Ord.	32/3	28/9	15	15	28/9	—	10 0 0
Assoc. Elec. :							
Ord.	45/3	34/9	10	10	38/6	+6d.	5 4 0
Pref.	36/6	34/–	8	8	33/9	—	4 11 10
Automatic Telephone & El.	46/6	39/3	10	12½	45/–	−¼	5 11 1
Babcock & Wilcox	42/9	37/–	10	12½	44/6	—	5 13 1
British Aluminium Ord.	57/–	48/9	12½	12½	57/6	—	4 7 0
British Insulated Ord.	88/–	77/–	20	20	4⅛	—	4 18 6
British Thermostat (5/–)	16/–	12/–	18½	18½	13/3	—	6 19 7
British Vacuum Cleaner(5/–)	22/6	18/6	40	40	18/9	—	—
Brush Ord.	5/9	4/6	Nil	Nil	5/–	—	—
Callender's	92/–	67/6	20	15	66/3xd.	+3d.	4 10 8
Chloride Elec. Storage	82/3	73/–	15	20	3¾	—	5 6 8
Consolidated Signal	96/–	80/9	36½	36½	82/6	—	8 16 9
Crabtree (10/–)	25/6	21/6	17½	17½	22/6	—	7 15 7
Crompton Parkinson :							
Ord. (5/–)	21/–	14/9	12½	15	17/6	—	—
E. K. Cole (5/–)	9/–	4/–	5	10	5/3	—	9 10
Elec. & Musical Industries (10/–)	14/9	8/9	10	5	11/3	—	4 9 0
Electric Construction	38/6	30/6	10	12½	37/6	+½	6 13 4
Enfield Cable Ord.	58/6	2½	25	16½	50/–	—	6 10 0
Electrical Switchgear (10/–)	27/–	23/9	16	16	23/9	—	6 14 9
English Electric	36/–	30/3	10	10	34/–	—	5 17 8
Ensign Lamps (5/–)	14/6	13/9	—	25	14/–	—	8 18 6
Ericsson Tel. (5/–)	43/–	35/–	25*	25*	41/3	+⅛	3 0 6
Ever Ready (5/–)	24/–	19/3	35	30	19/6	—	7 14 0
Falk Stadelmann	27/–	22/6	10	10	22/6	—	8 18 0
Ferranti Pref.	25/6	23/6	7	7	24/–	—	5 16 8
G.E.C. :							
Pref.	31/9	29/3	6½	6½	28/9xd.	+2/–	4 10 6
Ord.	82/–	70/9	17½	20	80/–	—	5 0 0
Greenwood & Batley	27/6	24/6	7	15	26/3	—	11 8 2
Hall Telephone (10/–)	22/3	19/3	15	15	21/3	+6d.	7 1 2
Henley's (5/–)	21/–	17/9	20	20	18/9	—	5 6 8
4½% Pref.	23/–	21/6	4½	4½	22/6	—	4 0 0
Hopkinsons	44/6	37/3	12½	15	45/–	+6d.	6 13 4
India-Rubber Pref.	21/–	20/–	5½	5½	21/3	—	5 3 6
Intl. Combustion	117/–	97/–	32½	32½	5⅛	—	5 17 0
J. Lucas	60/–	52/–	15	15	57/6	—	5 4 4
Johnson & Phillips	41/–	32/–	12½	12½	37/6	—	6 13 6
Lancashire Dynamo	68/–	60/–	25	25	60/–	—	8 6 8
Laurence Scott (5/–)	12/–	10/–	15	15	10/9	+9d.	7 4 7
London Elec. Wire	31/6	29/–	12	7½	29/6	—	5 1 8
Mather & Platt	50/–	42/6	13½	13½	46/3	—	5 17 0
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 6
Murex	85/9	63/9	20	20	4	+⅛	5 0 0
Pye Deferred (5/–)	13/9	7/6	5	25	10/–	—	12 10 0
Revo (10/–)	35/6	32/3	12	17½	33/9	—	5 3 8
Reyrolle	61/–	52/6	12½	12½	56/3	—	4 9 0
Siemens Ord.	26/9	20/6	7½	7½	23/9	+⅛	6 6 4
Strand Elec. (5/–)	5/6	4/9	5	10	5/–	—	10 0 0
S. Smith (1/–)	9/9	6/–	37½	50	8/9	—	5 14 3
Switchgear & Cowans (5/–)	15/–	11/3	20	20	11/3	—	8 18 0
Telegraph Condenser (10/–)	7/6	5/–	5	—	7/6	—	—
Telegraph Construction	2½	37/6	10	10	37/6	—	5 6 8
Telephone Mfg. (5/–)	10/–	8/–	9	9	9/–	+6d.	5 0 0
Tube Investments	91/–	82/9	23¾	23¾	88/3	+⅛	5 8 10
Vactric (5/–)	4/3	2/3	10	4	3/–	−6d.	6 13 4
Vickers (10/–)	24/6	19/6	10	10	18/9	−9d.	5 6 8
Westinghouse Brake	54/9	43/9	17½	17½	46/3	—	7 11 4
Walsall Conduits (4/–)	31/9	24/–	55	55	27/–	+9d.	8 3 0
West, Allen (5/–)	7/6	5/9	7½	10	6/3	—	8 0 0

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

17357. "Road traffic control systems." Siemens and General Electric Railway Signal Co., Ltd., and F. G. Tyack. July 22nd, 1937. (Addition to 450602.) (504552.)

23278. "Method of selecting electric waves without the use of resonance." L. Gabrilovitch. September 5th, 1936. (504455.)

25435. "Electric clocks." T. A. Brown and Perivale Clock Manufacturing Co., Ltd. September 9th, 1938. (504553.)

25945. "Radio receiving systems." Marconi's Wireless Telegraph Co., Ltd. September 24th, 1936. (504616.)

28601. "Electric gas-blast switches." British Thomson-Houston Co., Ltd. October 21st, 1936. (504556.)

28892. "Electric discharge devices." British Thomson-Houston Co., Ltd. October 22nd, 1936. (504783.)

28896. "Electric motor control." British Thomson-Houston Co., Ltd. October 22nd, 1936. (504715.)

28905. "High-tension ignition systems." Bendix Aviation Corporation. October 24th, 1936. (504386.)

28918. "Manufacture of electrolytic condensers." A. H. Hunt, Ltd. (Solar Manufacturing Corporation.) October 22nd, 1937. (504559.)

28981. "Superheterodyne radio receivers." E. K. Cole, Ltd., and H. A. Brooke. October 23rd, 1937. (504560.)

28993. "Voltage regulation of electric dynamos." Simms Motor Units, Ltd., S. C. Knight, and D. Pryke. October 23rd, 1937. (504785.)

28994. "Voltage regulators, cut-outs, and/or contactors for electric dynamos." Simms Motor Units, Ltd., and C. W. Mallett. October 23rd, 1937. (504561.)

29072. "Production of synchronising impulses in a television transmitter." Radio Akt.-Ges. D. S. Loewe. October 26th, 1936. (504460.)

29099. "Mercury switches for electric circuits." Westinghouse Brake and Signal Co., Ltd., J. W. G. Kershaw, and A. W. Simmons. October 25th, 1937. (504462.)

29126. "Photo-electric exposure meters." H. F. Tonnies. October 25th, 1937. (504786.)

29131. "Means for controlling the excitation of DC electric motors." English Electric Co., Ltd., and H. S. Carnegie. October 25th, 1937. (504619.)

29224. "Electric cables." Standard Telephones and Cables, Ltd., T. R. Scott and J. K. Webb. October 26th, 1937. (504720.)

29265. "Contact breakers for magneto-electric machines." British Thomson-Houston Co., Ltd., L. Griffiths, and A. W. Masters. October 26th, 1937. (504723.)

29270. "Thermally-operated electric switches." K. Bader. October 26th, 1937. (504724.)

29368. "Circuit arrangements for producing saw-tooth wave form electric oscillations." British Thomson-Houston Co., Ltd., and D. J. Mynall. October 27th, 1937. (504725.)

29374. "Electrical safety switching apparatus for vehicles and aircraft." P. W. Dunn, and D. A. R. Albery. October 27th, 1937. (504622.)

29454. "Apparatus for the electric treatment of gaseous fluids." Lodge-Cottrell, Ltd. (Research Corporation of New York.) October 28th, 1937. (504396.)

29460. "Electric furnaces." Magnesium Metal Corporation, Ltd. (American Magnesium Metals Corporation.) October 28th, 1937. (504730.)

29529. "Aerial and associated feeder systems." Marconi's Wireless Telegraph Co., Ltd., N. Wells, and A. W. Ladner. October 28th, 1937. (504733.)

29588. "Electron multipliers, and circuits utilising them." Farnsworth Television, Inc. October 31st, 1936. (504629.)

29591. "Electron multiplier." Farnsworth Television, Inc. November 9th, 1936. (504630.)

29640. "Electrical communication systems." Standard Telephones and Cables, Ltd., and F. G. Filby. October 29th, 1937. (504739.)

29667. "Navigation-aiding radio transmitters." Marconi's Wireless Telegraph Co., Ltd., C. S. Cockerell, and J. G. Robb. October 29th, 1937. (504744.)

29669. "Remote-control systems on three-phase electric networks." G. Santucci. October 30th, 1936. (Addition to 489694.) (504402.)

29760. "Electric condensers." Dubilier Condenser Co. (1925), Ltd., and J. H. Cotton. October 30th, 1937. (504748.)

29761. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. October 31st, 1936. (504749.)

29818. "Permanent magnet devices for producing axially symmetrical magnetic fields." F. H. Nicoll. November 1st, 1937. (504802.)

29820. "Antenna systems." Marconi's Wireless Telegraph Co., Ltd. October 31st, 1936. (504752.)

29854. "Snap-action mechanism for operating electric switches, valves or like devices." General Electric Co., Ltd., H. C. Turner and A. Sherwin. November 1st, 1937. (504757.)

29991. "Electric radiators." G. J. Berry and C. A. Painton. November 2nd, 1937. (Cognate application 34642/37.) (504761.)

30402. "Device for use in wireless receiving apparatus." B. W. Gardner. November 5th, 1937. (504573.)

30472. "Electric hotplates." G. H. Ide. November 6th, 1937. (504637.)

30880. "Boiling plates for electric cookers." British Thomson-Houston Co., Ltd., and R. E. Plested. November 10th, 1937. (504640.)

31866. "Electromagnetically operated mechanical shavers or haircutters and the like." Wilkinson Sword Co., Ltd., H. B. Randolf, and A. Mathisen. November 19th, 1937. (504645.)

32788. "Mechanical interlocks for electric switches and the like." Igranic Electric Co., Ltd., and S. R. Wright. November 27th, 1937. (504477.)

1938

1674. "Circuit arrangement for preventing wrong connections in telegraph selector systems." E. E. Towler (Siemens and Halske Akt.-Ges.) January 18th, 1938. (504411.)

1695. "Electrodes of secondary batteries. Young Accumulator Co., Ltd., H. De Martis, and S. J. Clark. January 18th, 1938. (504482.)

1732. "Electrostatic condensers." R. Bosch Ges. January 19th, 1937. (504412.)

3433. "Television transmission apparatus." Scophony, Ltd., G. Wikkenhauser, and A. F. H. Thomson. February 3rd, 1938. (504668.)

4222. "Electric cables." Callender's Cable and Construction Co., Ltd., and G. M. Hamilton. February 10th, 1938. (504670.)

5003. "Phase and frequency modulating circuit arrangements." Marconi's Wireless Telegraph Co., Ltd. April 13th, 1937. (504766.)

5171. "Method of and means for determining distances by means of electromagnetic waves." Standard Telephones and Cables, Ltd. May 15th, 1937. (504767.)

6941. "Resistance wires or the like." C. A. H. Jahn and Johnson Matthey and Co., Ltd. March 5th, 1938. (504768.)

13945. "Printing-telegraph automatic exchange system." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). May 10th, 1938. (Convention date not granted.) (504501.)

14442. "Compass-controlled switch." O. Neubert, Jun. May 14th, 1938. (504502.)

14547. "Radio receivers or other radio-frequency amplifiers provided with automatic volume control." Aga-Baltic Radio Aktiebolag. May 15th, 1937. (504421.)

14962. "Electrically heated pipes for conveyance of liquids." F. Hejduk and J. Neumann. May 19th, 1937. (504506.)

15107. "Systems of guiding by radio-electric waves, particularly for guiding aeroplanes in altitude." Standard Telephones and Cables, Ltd. June 11th, 1937. (504507.)

15474. "Multi-conductor telephone cord and connector." Standard Telephones and Cables, Ltd. June 5th, 1937. (504422.)

15631. "Centrifugal electric switches." British Thomson-Houston Co., Ltd. May 25th, 1937. (504678.)

15939. "Sequentially operating circuit arrangements suitable for use for sequential switching." Marconi's Wireless Telegraph Co., Ltd. May 28th, 1937. (504680.)

18314. "Ionisation chamber apparatus for measuring electric radiation." Siemens & Halske Akt.-Ges. June 22nd, 1937. (504429.)

18656. "Electric circuits using dry contact rectifiers." Suddeutsche Apparate-Fabrik Ges. June 23rd, 1937. (504516.)

19115. "Electric switches." W. Bartsch. July 8th, 1937. (504686.)

19417. "Electric flash signal apparatus." Svenska Aktiebolaget Gas-Accumulator. July 3rd, 1937. (504778.)

20819. "Electron-discharge devices having metal envelopes." British Thomson-Houston Co., Ltd. July 14th, 1937. (504690.)

20928. "Apparatus for converting direct-current to periodic varying current." K. H. Schmidt and M. Widakowich. July 29th, 1937. (504523.)

21259. "High-pressure mercury-vapour electric discharge lamps." General Electric Co., Ltd. July 28th, 1937. (504532.)

21521. "Image analysing and dissecting tube for television systems." Farnsworth Television, Inc. August 17th, 1937. (504526.)

21677. "Electric welding machines." British Thomson-Houston Co., Ltd. July 21st, 1937. (504691.)

22217. "Radio direction-finding systems." C. Lorenz Akt.-Ges. July 26th, 1937. (Addition to 490650.) (504434.)

22265. "Permanent magnets, and processes for the production thereof." Fides Ges. für die Verwaltung und Verwertung von Gewerblichen Schutzrechten. August 4th, 1937. (504435.)

23350. "Electric timepieces." Soc. Auxiliaire pour la Developpement d'Industries Mécaniques (S.A.D.I.M.). August 11th, 1937. (504694.)

23399. "Voltage regulating systems." British Thomson-Houston Co., Ltd. August 11th, 1937. (504695.)

24169. "Moving-contact electric current convertors." Siemens-Schuckertwerke Akt.-Ges. August 16th, 1937. (Addition to 492369.) (504531.)

24693. "High- or intermediate-frequency thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabriken. August 25th, 1937. (504696.)

25140. "Control arrangements for electric switches." British Thomson-Houston Co., Ltd. August 30th, 1937. (504532.)

25513. "Electrically heated ovens." O. Uhlendorff. August 31st, 1937. (504697.)

25715. "Electric picture-reproducing means." Photo Electrograph, Ltd., and J. P. Frater. September 2nd, 1938. (504533.)

26707. "Grounding device for coaxial conductor lines." Standard Telephones & Cables, Ltd. September 22nd, 1937. (504442.)

27265. "Resonant circuit arrangements." Telefunken Ges. für Drahtlose Telegraphie. September 17th, 1937. (Addition to 502593.) (504443.)

29756. "Electric interrupters." R. Bosch Ges. November 29th, 1937. (504779.)

31238. "Bases for vacuum electric discharge devices." British Thomson-Houston Co., Ltd. October 30th, 1937. (504449.)

31719. "Automatic lighting of an electric stop-signal on cycles." C. M. Bjelving. November 4th, 1937. (504450.)

33946. "Magnetron telegraphic repeater." Creed & Co., Ltd. December 20th, 1937. (504708.)

34907. "Terminals for electric condensers." Mallory Patents Holding Co., Ltd. April 14th, 1938. (504452.)

37464. "Signal receivers for carrier-telephony systems." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 27th, 1937. (504711.)

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Aberdare.—May 27th. U.D.C. Cables, switchgear and transformers. (May 19th.)

Australia.—VICTORIA.—June 27th. State Electricity Commission. V.i.r. copper cable. (T. 22826/39.)*

Belfast.—June 2nd. Electricity Department. 145,000 tons of coal, water cleaning screen, mild-steel galleries and stairways and an electrically operated lift for Harbour power station; steel poles for street lighting lanterns. (May 12th.)

Saturated steam pipework and valves for the Harbour power station. (May 19th.)

Berkshire.—June 16th. County Council. Electric lighting installation at Newbury Public Assistance Institution. (See this issue.)

Burnley.—May 31st. Electricity Department. Four 400-kVA transformers. (See this issue.)

June 3rd. Lighting installation in Parish Church. (May 12th.)

Birmingham. — June 2nd. Electric Supply Department. Extra-high-voltage metal-clad switchgear to Spec. No. SE.99. (May 19th.)

June 12th. Four electric cranes at Hams Hall "B" power station. (See this issue.)

July 10th. Two ferro-concrete cooling towers at Hams Hall "B" power station. (See this issue.)

Cheadle and Gatley.—June 12th. Electricity Department. Extensions to 6.6-kV switchgear at the Cheadle main substation. (See this issue.)

Dublin.—August 1st. Electricity Supply Board. Turf burning boiler plant and auxiliaries at a generating station near Portarlington, Co. Leix, also one 20/25,000-kW turbo-alternator and exciter with complete condensing and auxiliary plant. (May 19th.)

Ealing.—June 1st. Electricity Department. Jointing materials, general stores and pavement frames and covers for twelve months. (May 12th.)

Edinburgh.—June 2nd. Corporation. Electrical installation at Holy Cross Academy. Town Clerk.

June 2nd. Electrical installations at Broughton Secondary, Duncan Street Special, and Gorgie schools. Town clerk.

Hastings.—June 2nd. Electricity Department. Boiler fuel for twelve months. (May 19th.)

Holmfirth.—May 26th. Electricity Department. High- and low-voltage cables.

June 2nd. Unit comprising extra-high-voltage switchgear, transformer and low-voltage fuses. (May 19th.)

Huddersfield.—June 12th. Electricity Department. Complete electric goods lift installation. (See this issue.)

India. — SIMLA.—June 10th. Indian Stores Department. DC motors and starters. (T.Y. 22672/1939.)*

Lanark.—May 30th. County Council. Electric lighting installations in thirty-five houses. W. A. Brown, county housing architect and engineer, 13, Clydesdale Street, Hamilton.

Llandrindod Wells.—June 8th. Electricity Department. Mercury-arc rectifier equipment. (See this issue.)

Leeds.—June 1st. Sewerage Committee. Sewage-pumping equipment, comprising electrically driven centrifugal pumps, motors, control and switchgear, cables, cast-iron pipes, valves and instruments in the main pumping station. Low Level Works, Knostrop. Town Clerk's Office, Room 57, Civic Hall (deposit £2).

June 12th. Corporation. X-ray installation at St. James's Hospital. (May 19th.)

London.—H.M. OFFICE OF WORKS.—May 31st. Electric wiring installation at Glascoed R.O.F. (May 12th.)

June 13th. Installation of high- and low-voltage cables and control gear at the National Physical Laboratory, Teddington. (See this issue.)

Commissioners of H.M. Works and Public Buildings. June 8th. Electrical accessories. (See this issue.)

Merton and Morden.—May 31st. U.D.C. Diesel-electric stand-by plant at the West Barnes sewage pumping station. (May 19th.)

Newcastle-on-Tyne. — North - Eastern Housing Association. Electrical installations in forty-four houses at Spennymoor. G. H. Gray, architect, 50, Camden Street, North Shields.

Newport.—June 1st. Electricity Department. Civil engineering works, including pipework and river outfall, in connection with additional circulating water supplies at the East power station. (May 12th.)

June 5th. Extra-high and low-voltage transmission lines for electricity supplies in the Magor Rural District. (May 19th.)

June 13th. Directors. Electrical installation and equipment at the Royal Gwent Hospital.

New Zealand. — WELLINGTON. — June 28th. Post and Telegraph Department. 5,000-ft. of cable. (T. 22770/39.)*

June 27th. Public Works Department. Two electric cranes and two electric hoist blocks. (T. 22774/39.)*

July 4th. Distribution switchboard for R.N.Z.A.F. Station, Blenheim. (T. 22773/39.)*

July 11th. Outdoor switchgear for 11-kV distribution lines at Waikaremoana main station. (T. 22768/39.)*

Nottingham.—June 13th. Electricity Undertaking. General stores for twelve months. (See this issue.)

Plymouth. — May 27th. Electricity Supply Department. Two 33,000/6,600-V transformers and auxiliary apparatus. (May 12th.)

Reigate.—June 10th. Electricity Department. Four sheet-steel kiosks complete with high- and low-voltage switchgear and six 400-kVA transformers. (May 19th.)

June 10th. Extra-high voltage and low-voltage cables. (May 19th.)

Salford.—June 9th. Electricity Department. Samples of electrical materials. (See this issue.)

Stoke-on-Trent.—June 14th. Electrical Engineer's Department. One 8-cwt. electric van. (See this issue.)

South Africa.—JOHANNESBURG. — July 11th. Rand Water Board. One 3,000-kW steam turbine, together with condenser and auxiliary valves and instruments, cables and wiring. (T. 22297/39.)*

July 14th. Electricity Supply Commission. 40,000-kW turbo-alternator and condensing and auxiliary plant for Congella power station. (T. 22298/39.)*

PRETORIA.—June 1st. Union Tender and Supplies Board. One 100-kVA alternator and one automatic voltage regulator. (T. 22296/39.)*

CAPE PROVINCE.—June 1st. Gordons Bay Village Management Board. One 60-kVA transformer and one automatic line voltage regulator. (T. 22580/1939.)*

PORT ELIZABETH.—June 8th. City Electrical Engineer's Department. Low-voltage cable, house service meters, hard-drawn copper wire, house service cut-outs, transformers, metal-clad single bus-bar switch panels and slot meters. (T. 22709/39.)*

June 8th. Metal-clad double bus-bar switchboard. (T. 22586/1939.)*

CAPE TOWN.—June 14th. Electricity Supply Undertaking. Two three-phase current limiting reactors. (T. 22731/39.)*

NATAL.—June 21st. Provincial Tender Board. One electric lift at the maternity ward block, Grey's Hospital, Pietermaritzburg. (T. 22739/39.)*

Spenborough.—June 9th. Electricity Department. One 12-panel, 11,000-V switchboard. (See this issue.)

Stockton-on-Tees.—June 6th. Electricity Department. One 750-kVA and two 500-kVA transformers. (May 19th.)

Swansea.—May 27th. Electricity Department. Mercury-arc rectifier equipment. (May 12th.)

Tredegar.—June 3rd. U.D.C. Automatic fire-fighting system for the Central sub-station and two manual systems for North and South sub-stations. (May 19th.)

Wallsend.—Town Council. Electrical installation at the new maternity and child welfare centre and school clinic. Plans by J. A. Blench, borough engineer.

Weymouth and Melcombe Regis.—May 30th. Electricity Department. Extra-high-voltage switchgear and transformers. (May 12th.)

Orders Placed

Brighton.—Electricity Committee. Recommended. Control panels required for two new boilers at Southwick power station (£3,836).—Bailey Meters Co.

Grimsby.—Electricity Committee. Recommended. Four 100-kVA transformers (£404).—Brush Electrical Engineering Co.

London.—L.C.C. Accepted. Wiring and fittings for electric lighting in part block of dwellings in the Hurlock Street area, Islington (£1,314).—Samuel Reed & Sons.

Accepted. Electrical installation at Norwood technical institute (£1,507).—W. G. Perry & Co.

WESTMINSTER.—A.R.P. Committee. Accepted. Lighting equipment for

(*Continued on next page*)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 17th.

Ticonal. No. 605,690. Class 6 (IV). Magnetic metals and alloys thereof. Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Neco (lettering and design). No. 600,714. Class 9 (IV). Rectifier charging apparatus for electric batteries, electric measuring instruments, electro-plating apparatus, electric condensers, induction apparatus, current rectifiers, transformers, converting machines, radio and television apparatus, electric floor polishers, flat irons, kettles, coffee percolators, saucepans, casseroles, automatically operated electrical apparatus for making tea, curling irons, waffle irons, soldering irons, etc. Normand Electrical Co., Ltd., Neco Works, North Street, Clapham Common, S.W.4.

Victor. No. 603,897. Class 9 (IV). Electrical plugs and sockets, and electric cable couplings. Charles Crofton & Co. (Engineers), Ltd., Church Bank Offices, North Terrace, Wallsend-on-Tyne.

Ozuriet. No. 604,481. Class 9 (IV). Electrical apparatus and instruments and electric cables, wire and flexibles. Naamlooze Venootschap Hollandsche Draad en Kabelfabriek, Amsterdam. (British representatives: J. E. Evans-Jackson & Co., 57-60, Holborn Viaduct, E.C.1.)

RT (lettering and design). No. 605,035. Class 9 (IV). Electric and magnetic switches, etc. Ronald Trist & Co., Ltd., 1-3, Brixton Road, S.W.9.

Three Elephants (design only). No. 605,059. Class 9 (IV). Electric batteries. General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Bestosking. No. 602,459. Class 9 (IV). Firefly (lettering and design). No. 602,976 (IV), and Lomoto No. 603,864. Class 9 (IV). Electrical insulation material, insulators, vulcanised fibre, etc. Turner Bros. Asbestos Co., Ltd., Clod Mills, Spotland, Rochdale, Lancs.

trenches.—Buchanan & Curwen (£651); Electrical Installations (£328); Belshaw & Co. (£225).

Milford Haven. — General Purposes Committee. Accepted. Installation of an electrically wound turret clock in the church tower (£331).—Gillett & Johnston.

Newcastle-on-Tyne.—City Council. Accepted. Electric lighting installation at the Fawdon Junior and Infants' School (£266).—A. S. Lowery.

Portland.—Electricity Committee. Accepted. Electric fires.—Berry's Electric.

Whitley and Monkseaton.—U.D.C. Accepted. Electrical installation in houses on the Hartley housing estate (£277).—J. B. Wilson.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Nursery school and child welfare centre at Hilton for Corporation; City architect.

Aethwy (ANGLESEY).—Houses (45) at Llanfair P.G., Trem Eryri, Llangristiolus and Gaerwen Rhesdai, for R.D.C. (£20,225); Henry Jones & Sons, contractors, 7, Beach Road, Rhosneigr Anglesey.

Alnwick.—Hospitals at Alnwick and Berwick, for the North Northumberland Joint Hospital Board; R. J. Middlemas, clerk, Alnwick.

Ashford (KENT).—Buildings for Ashford Grammar school; W. H. Robinson, Kent county council architect, Springfield, Maidstone.

Bangor.—Normal Training College, extensions (£95,000).

Birmingham. — Housing estate, off Knowle By-Pass; Rexford (Builders), Ltd., Newborough Road, Shirley, Birmingham. Factory, Bromford Lane, Washwood Heath; F. Lindsay Bullivant, architect, 156, Bristol Road. Three-storey factory building on the Soho Road, Handsworth; W. J. Whittall & Son, builders, Lancaster Street.

Blackpool.—Dining pavilion and reception office (£15,000), for Squires Gate Holiday Camp, Ltd.; H. H. Vickers & Son, Ltd., contractors, Back Palatine Road, Blackpool. Victoria Hospital extensions, Whinney Heys Road; J. & R. Fenton (Blackpool), Ltd., contractors, Chaunce Street, Blackpool.

Blidworth (NOTTINGHAMSHIRE). — Pithead baths, Rufford Colliery (£22,399); H. James (Mansfield), Ltd., contractors, Station Street, Mansfield.

Bootle.—Extensions to works, Linacre Lane and Hawthorne Road, for Liverpool Electric Cable Co., Ltd.; J. P. Parrish, architect, Broad Road, Sale, Cheshire.

Brighton.—Flats and shops, Marine Drive; Riflebutt Properties, Ltd. Extensions, Arlington Hotel, Marine Parade; Courage & Co., Ltd.

Bromsgrove. — Estate development, Broad Street and Providence Road, Sidemoor; R. E. Griffin, architect, G. C. Gadd, Town Hall Chambers.

Burton-on-Trent. — Grammar school; Buckland & Haywood, architects, Norwich Union Chambers, Congreve Street, Birmingham.

Chester.—Houses (89), and 24 flats, Lache estate (£37,244); E. B. J. Gould.

Congleton.—Houses (94), various parishes (£40,000); R.D.C. surveyor.

Coventry.—Cinema, Binley Road, for E. Woodhead; R. Satchwell, architect, 6, New Street, Birmingham.

Crook (Co. DURHAM).—Factory, for J. Putley and Co., Ltd., box and packing case makers, St. James's Road, London, S.E.1.

Croydon. — Church hall, Normanton Road, for Emmanuel Church; Mr. D. Pickard. Rebuilding 91-3, North End; Stockwell & Oxford.

Darlington.—Offices, Neasham Road, for J. Tinsley, Ltd.; W. S. Hutton, Ltd., builders, Post House Wynd, Darlington.

Derby. — Licensed premises at the Burnaston Airport (£20,000); T. H. Thorpe, architect, 23, St. James Street, Derby.

Devonport.—Cinema, for St. Budeaux Cinema Co., Ltd.; L. F. Richardson, Ltd., builders, 34, Mount Ephraim Road, London, S.W.16.

Dudley.—Police buildings (£53,000); G. F. Webb, architect, High Street.

Dunfermline.—Houses (171), Headwell Avenue, for T.C.; burgh surveyor.

Easington.—Operating theatre, Institution hospital; county architect, 43, Old Elvet, Durham.

Edinburgh.—Assembly hall and pharmaceutical departments (£50,000), for Governors of the Heriot-Watt College.

Epsom.—Ward block (£14,000), Epsom and Ewell Cottage Hospital, Alexandra Road; Williams, Pettett & Gardner, architects, 58, High Street, Guildford.

Fife.—Cinema at Methilhill (£14,000); L. A. Rolland, architect, High Street, Leven, Fife. Cinema in Kelty (£12,000); Mr. L. A. Rolland, architect, High Street, Leven, Fife.

Gateshead-on-Tyne.—Extensions to Sigment Pumps Co.'s factory on North-Eastern Trading Estate; W. & T. R. Milburn, 17, Fawcett Street, Sunderland, architects. Factory, North-Eastern Trading Estate; G. H. Gray, architect, 50, Camden Street, North Shields. Wire factory, Team Valley estate, for L. V. Diamant; G. C. Hadden and Hillman, builders, 127, New Bridge Street, Newcastle-on-Tyne.

Glasgow.—Church, Castlemilk Road; T. W. Kennedy, architect, 239, St. Vincent Street. Church Halls, Anniesland Road; J. Taylor Thomson and Partner, architects, 212, Bath Street. Church Hall and houses at Maryhill Road; Balfour & Stewart, architects, 110, Blythswood Street.

Greenwich.—Rehousing, Renbold Place area (£56,800); L.C.C. architect.

Grimsby. — Baths, Scartho Road (£52,000); borough engineer.

Halesowen.—Development of 22-acre site for houses, Hurst Green; borough surveyor.

Hinckley.—Houses (50), Woodland Avenue, Burbage; U.D.C. surveyor.

Holland.—Air raid shelters for schools (£30,000), for E.C.; County architect, County Hall, Boston, Lincs.

Horden.—Drill hall, for the Territorial Army; John Proud, Ltd., builders, 195, York Road, West Hartlepool.

Houghton-le-Spring (Co. DURHAM).—Houses (138), for U.D.C.; V. Hunter, surveyor, council offices.

Irlam.—Surgenor & Co., Ltd., builders, Moss Lane, Bramhall, near Stockport, are developing new housing estate between Liverpool Road and Brook Grove, Irlam.

Keighley.—Church, West Lane, Guard House, Estate; G. Clarke, architect, Empsall, Clarkson & Clarke, 18, North Park Road, Manningham, Bradford.

Kincardine-on-Forth. — Luxury hotel; John Adam, hotel proprietor, 2, Albert Place, Stirling.

Knowle.—Development, Glebe Upper estate; Rexford Builders, Ltd., Shirley, Birmingham.

Leamington.—Senior school, for 120; R.C. Trustees.

Leeds.—Offices (12-storey) and shops, &c., The Headrow, for Prices Tailors, Ltd.; Adie, Button & Partners, architects, 30, George Street, W.1.

Leigh (LANCS).—Houses (250), Common Lane; A. T. Clare, borough surveyor.

Lichfield.—Hospital for Mid-Staffordshire Joint Hospital Board. Senior council school and art school for the Staffs Education Committee (£32,886); Green & Bird, builders, Hednesford.

Lindsey.—School, Priory Lane, Ashby, Scunthorpe (£22,500), for E.C.; director of education, Lincoln.

Liverpool.—Factory on Stopgate Lane, Fazakerley, for Bradley's (Chester) Ltd. (£17,000); E. B. Bailey, architect, 51, North John Street, Liverpool. Community centre (£30,000), Norris Green; L. Keay, architect.

London.—(CHELSEA). — Working-class dwellings, Rile Street area, for B.C.; E. W. Armstrong, architect, 19, Hobart Place, London, S.W.1. (HIGHGATE). — Cinema (£60,000), Junction Road, for Odeon Cinema Holdings, Ltd.; Gee, Walker & Slater, Ltd., contractors, Fitzmaurice Place, Berkeley Square, W.1. (HITHER GREEN).—Factory, 78-92, Nightingale Lane; Davis Bros. (Motor Supplies), Ltd., Nightingale Grove. (ISLINGTON). — Rebuilding, North London Drapery Stores, Seven Sisters Road; Provident Clothing & Supply Co. Redevelopment, 13-20, City Garden Row; Debenham, Tewson & Chinnock. (LAMBETH).—Hall, Dorset Road area; Salvation Army. Dwellings and clinic, Fount Street area (£46,869); borough engineer. (NEW CROSS).—Rebuilding factory, Wilson Street, for Yanatas, Ltd.; H. Ashworth, architect, 2, Woodberry Avenue, North Harrow. (PADDINGTON).—Extensions to Town hall (£66,690); William & Edward Hunt, architects, Brettenham House, Lancaster Place, W.C.2.

Macclesfield.—Extensions to General Post Office, Castle Street and Derby Street (£10,000); Cooper Bros. (Builders), Ltd., contractors, Catherine Street, Macclesfield.

Milford Haven.—Development, Steynton estate; T. Jenkerson.

Monkseaton.—Church for the Presbyterian trustees; Tasker and Child, architects, Trinity Buildings, New Bridge Street, Newcastle-on-Tyne.

Newcastle - on - Tyne. — Elementary school, Waterworks Road, for the E.C. (£12,000); E. Thompson, builder, 12, Grey Street. Extensions to King's College (£90,000); W. B. Edwards, architect, 52, Eldon Place. R.C. central school at the Fossway; remodelling St. Lawrence's School; new senior R.C. school at Ennerdale Road; and remodelling of St. Dominic's School; R. Burke, architect, Singleton House, Northumberland Road.

Northolt.—Cinema, Mandeville Road, Way & Walker; F. E. Bromige, architect, 3, Kingly Street, W.1.

Nuneaton.—R.C. School; trustees.

Orpington. — Extensions to offices (£28,000), for U.D.C.; R. Atkinson, architect, 13, Manchester Square, W.1.

Oswestry.—Council elementary school at Morton, for Shropshire E.C. (£17,267); Alun Edwards, contractors, Cefn-y-Bedd, Wrexham.

Peterborough. — Maternity block, Memorial Hospital; Governors. Senior school (£33,932); Education Committee.

Portsmouth.—Houses (600), Wymering, for T.C.; borough surveyor.

Sedgefield.—Houses (150); R.D.C. surveyor.

Sheffield.—Infants' and junior school, Whites Lane; C. B. Flockton, architect, of Flockton & Son, 19, St. James Row, Sheffield, 1.

Shrewsbury.—Elementary senior school for Church of England Authorities at Pontesbury (£17,200); W. Higley & Sons, contractors, 3, Pride Hill Chambers.

Slough. — Council offices (£18,000); Eton R.D.C.

Southampton.—Additions to University College.

Southgate. — Church hall, Bramley Road; T. H. Birchall-Scott.

Stafford.—Houses (125), Silkmore estate (£48,070); borough engineer.

Stockport. — Factory, Reddish, for Oswall MacCardell & Co., Ltd., Moss Park Road, Stretford.

Stockton-on-Tees.—R.C. senior girls' school; A. Harrison, architect, 69, High Street, Stockton. Houses (72), for H. Cohen; G. P. Stainsby, architect, 25, High Street.

Stonehouse (GLOUCESTERSHIRE).—Factory, site near Avenue Terrace; Hoffmann Manufacturing Co., Ltd.; Bedford Square, London, W.C.1.

Sunderland.—Laboratory in Hadrian Street, for Jobling & Co.; J. Carter & Son, builders, Deptford, Sunderland. Reconstruction of premises of Sunderland Savings Bank (£6,000); Randle & Co., Back Dunelm Street, Sunderland, contractors.

Sutton Coldfield.—Senior schools, Holland Road, for E.C.; Alderman T. W. Lawrence, School Management Sub-Committee.

Swansea.—Houses (124), Forest Hall estate, Cadle (£56,306), for T.C.; Borough surveyor.

Tipton.—Houses (404), Upper Church estate (£144,550); borough engineer.

Walsall.—Cinema, Wallows Lane, for Magnet Entertainments, Ltd.; H. Robinson, architect, Cadogan Chambers, Cherry Street, Birmingham.

Washington (Co. DURHAM).—School, County Council (£38,000); D. Glen, contractor, Back Queen's Road, Jarrow.

Weymouth. — Isolation hospital (£49,354); Joint Hospital Board.

Willenhall.—Houses (250), Beacon Colliery estate; Scott & Clark, architects, 51, Low High Street, Wednesbury.

Willington (DURHAM).—School, for Durham County Council; D. Glen, contractor, Back Queen's Road, Jarrow.

Windsor.—Pumping station, Dedworth (£72,000), for T.C.; borough surveyor.

Woolsington (NORTHUMBERLAND).—Newcastle city airport extension (£20,000); P. Parr, city engineer, Town Hall, Newcastle-on-Tyne.